

AD-A072 899

WOODWARD-CLYDE CONSULTANTS PLYMOUTH MEETING PA  
NATIONAL DAM INSPECTION PROGRAM, MOUNTY AIRY DAM, NDS ID PA-008--ETC(U)  
APR 79

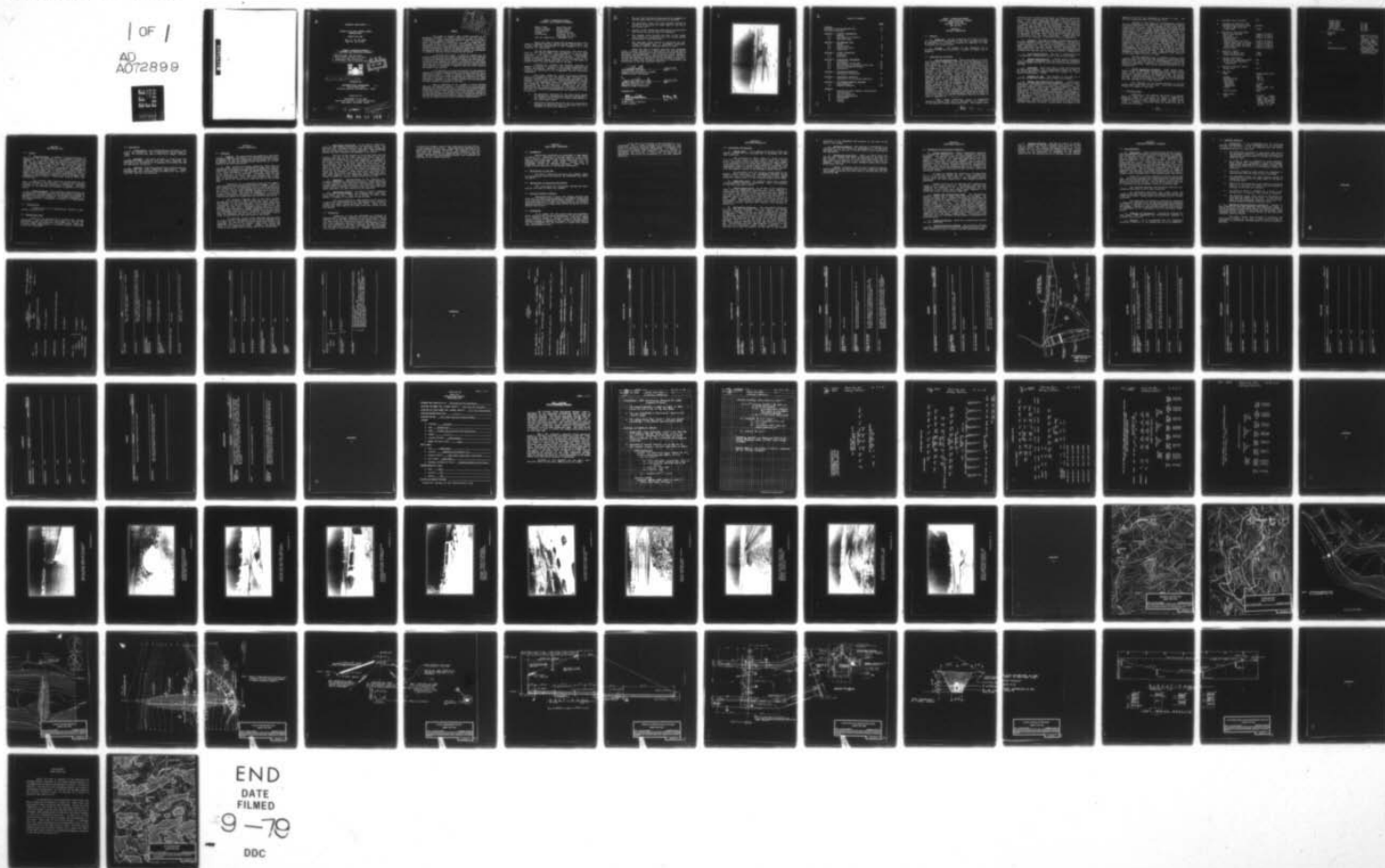
F/G 13/2

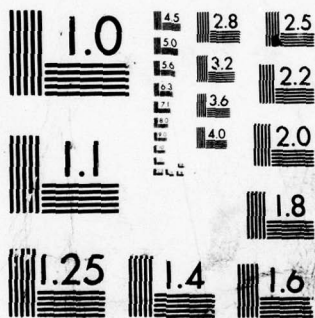
DACW31-79-C-0017

NL

UNCLASSIFIED

1 OF 1  
AD  
A072899





MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

ADAC72899

DELAWARE RIVER BASIN ✓

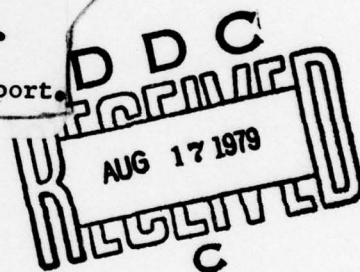
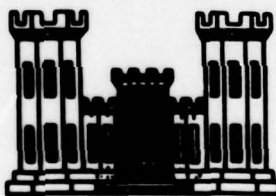
FOREST HILLS RUN, MONROE COUNTY  
PENNSYLVANIA

MOUNT AIRY DAM

NDS I.D. NO. PA 00811  
DER I.D. NO 45-243

⑥ PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

Mount Airy Dam. NDS ID PA-00811  
DER ID 45-243. Delaware River Basin.  
Forest Hills Run, Monroe Count,  
Pennsylvania. Phase I Inspection Report.



⑮ DACW 31-79-C-pp17

Prepared by:

WOODWARD-CLYDE CONSULTANTS ✓  
5120 Butler Pike  
Plymouth Meeting, Pennsylvania 19462

Submitted to:

DEPARTMENT OF THE ARMY  
Baltimore District, Corps of Engineers  
Baltimore, Maryland 21203

⑫ 847

⑩ APR 1979

This document has been approved  
for public release and sale; its  
distribution is unlimited.

79 08 13 103  
394157  
mt



## **PREFACE**

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Mount Airy Dam
County Located:	Monroe County
State Located:	Pennsylvania
Stream:	Forest Hills Run
Coordinates:	Latitude 41° 6.8' Longitude 75° 19.2'
Date of Inspection:	6 November 1978

Mount Airy Dam is owned and operated by Mount Airy Lodges in Paradise Township, Monroe County, Pennsylvania. The 42 foot high dam constructed in 1971 creates a 17.1 acre reservoir for recreation.

The dam and appurtenant facilities, with the exception of the sluice gates, are considered to be in good condition. The dam is classified as an "Intermediate" structure with a "High" hazard classification. The "High" hazard classification is consistent with the potential for extensive property damage and loss of life in the event of failure within one mile downstream of the dam.

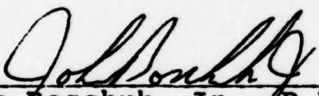
Calculations indicate the existing spillway is capable of passing 77 percent of the Probable Maximum Flood without overtopping. Therefore, the spillway system for this structure is considered to be "Inadequate" but not "Seriously Inadequate".

The visual inspection, review of available documentation and discussions with the Owner, DER, contractor and designer indicated that several modifications were made to the structure during construction. These modifications include raising of the embankment height by approximately four feet and increasing the spillway weir elevation by 2.5 feet. Considering the overall condition of the dam, and visual observations and evaluations discussed in Sections 3 and 6 of the text, the following recommendations are presented in order of priority.

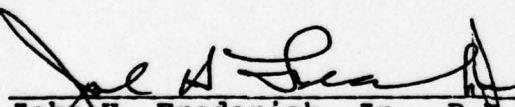
1. The mechanical operation of the sluice gate should be checked by a professional engineer and appropriate remedial action taken to correct deficiencies in the sluice gate stems.
2. Appropriate measures should be taken to clear debris clogging the pond drain gate in the event that it is necessary to drain the reservoir.

3. The toe drain discharge pipes should be inspected to confirm that they are functioning as designed.
4. The embankment crest and right abutment should be raised to an elevation at least equal to the top of the bridge deck.
5. Erosion on the downstream slope should be monitored and corrective action taken as necessary.
6. The leakage noted through the wall of the intake tower should be repaired during the normal annual maintenance of the structure.
7. The upstream riprap should be monitored for continued settlement and, if settlement continues, necessary remedial measures should be taken.

Since the dam is located upstream from populated areas, a formal procedure of observation and warning during periods of high precipitation and associated runoff should be developed and implemented. This procedure should include a written procedure for warning downstream residents. The Owner should also develop an operation and maintenance procedure to be used to insure that the dam is operated in a safe manner and maintained in the best possible condition.

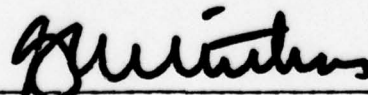
  
\_\_\_\_\_  
John Boschuk, Jr., P.E.  
Pennsylvania Registration 27450E  
Woodward-Clyde Consultants

23 April 1979  
Date

  
\_\_\_\_\_  
John H. Frederick, Jr., P.E.  
Maryland Registration 7301  
Woodward-Clyde Consultants

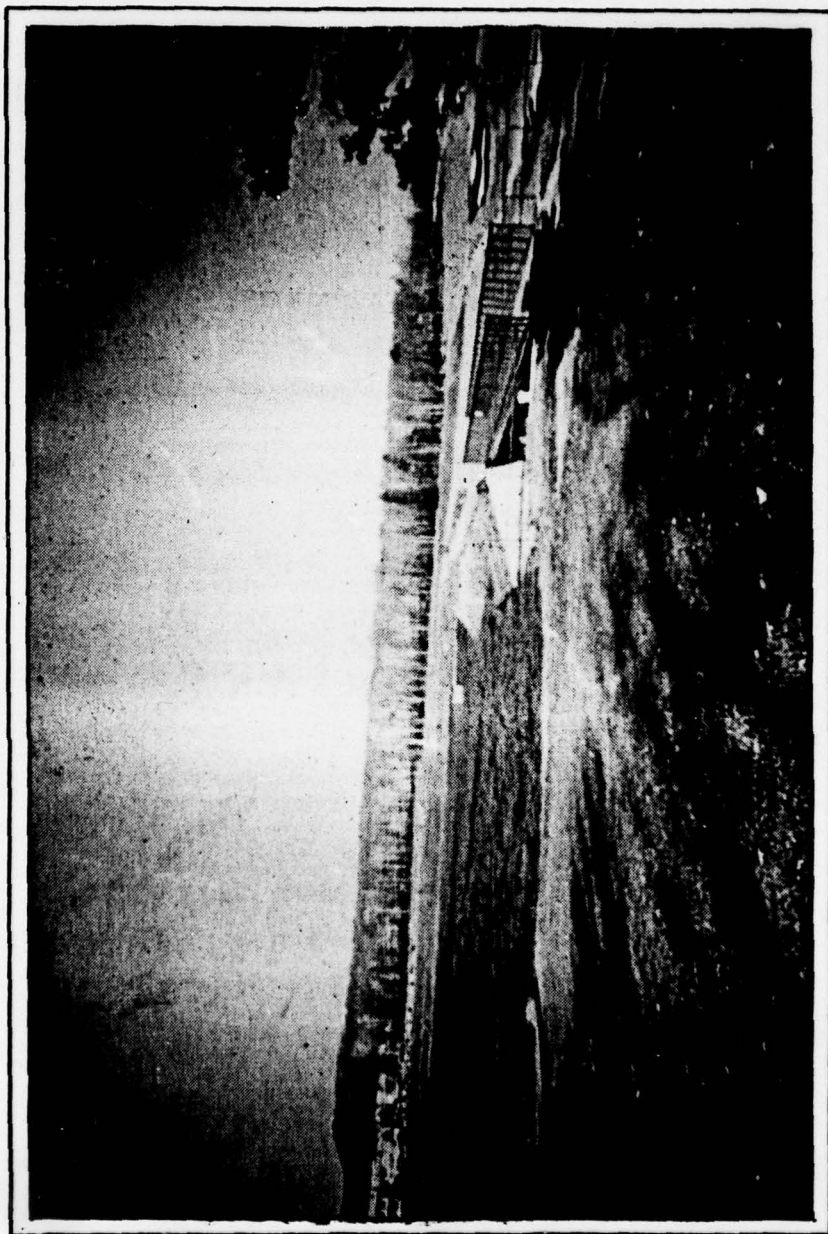
April 23, 1979  
Date

APPROVED BY:

  
\_\_\_\_\_  
G. K. WITHERS  
Colonel, Corps of Engineers  
District Engineer

19 May 79  
Date





OVERVIEW  
MOUNT AIRY DAM, MONROE COUNTY, PENNSYLVANIA

iv  
29 08 13 103

## TABLE OF CONTENTS

	<u>PAGE</u>
Preface	i
Assessment and Recommendations	ii
Overview Photograph	iv
 SECTION 1 - PROJECT INFORMATION	
1.1 General	1
1.2 Description of Project	1
1.3 Pertinent Data	3
 SECTION 2 - ENGINEERING DATA	
2.1 Design	6
2.2 Construction	6
2.3 Operational Data	6
2.4 Evaluation	7
 SECTION 3 - VISUAL INSPECTION	
3.1 Findings	8
3.2 Evaluation	9
 SECTION 4 - OPERATIONAL PROCEDURES	
4.1 Procedures	11
4.2 Maintenance of the Dam	11
4.3 Maintenance of Operating Facilities	11
4.4 Warning Systems In Effect	11
4.5 Evaluation	11
 SECTION 5 - HYDROLOGY/HYDRAULICS	
5.1 Evaluation of Features	13
 SECTION 6 - STRUCTURAL STABILITY	
6.1 Evaluation of Structural Stability	15
 SECTION 7 - ASSESSMENT/REMEDIAL MEASURES	
7.1 Dam Assessment	17
7.2 Remedial Measures	18
 APPENDIX	
A Engineering Data, Design, Construction and Operation	
B Visual Inspection	
C Hydrology/Hydraulics	
D Photographs	
E Plates	
F Geology	

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM  
MOUNT AIRY DAM  
NATIONAL ID #PA 00811  
DER #45-243

SECTION 1  
PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Mount Airy Dam is a 42 foot high zoned earth embankment, 700 feet long and impounds a 15.5 acre reservoir. The structure was built downstream of an existing dam which was razed after Mount Airy Dam was about to be filled. The dam contains a central impervious core which was compacted to at least 95 percent of the modified proctor density. The impervious core, constructed to the same elevation as the spillway crest, has a reported top width of 10 feet and 1H:1V slopes. Under the dam centerline is an eight foot wide, five foot deep core trench excavated into competent materials as determined by the resident engineer. The dam shell is a semi-impervious fill which was also compacted to at least 95 percent of the modified proctor density. The dam crest had a measured width of 10.5 feet and a design upstream slope of 2.5H:1V. The upstream slope is protected with 18 inches of riprap over a six-inch gravel bedding from the crest to 12.5 feet below the spillway crest elevation. The design downstream slope is 2H:1V and is covered with grass. The embankment also contains a gravel toe drain with eight-inch corrugated metal pipes which outlet in the 36-inch pipe. A typical embankment section is shown as Plate 4, Appendix E.

ABSTRACT

Under normal conditions, water is discharged through an intake tower near the upstream toe at Station 4 + 97 to maintain minimum downstream flow. The intake tower



contains three 24-inch sluice gates at different elevations and a 36-inch sluice gate two feet above the bottom of the tower. All water discharges through a 36-inch diameter reinforced concrete pipe, which has five anti-seep collars and is located at the base of the embankment. The discharge conduit is approximately 140 feet long and discharges at the downstream toe into a riprap lined channel. During storms, excess water is discharged over the concrete spillway located at the right abutment. The spillway is 80 feet wide less two bridge piers (16 inches thick) and discharges downstream where it converges with the tower discharge. Typical plan and profile of the spillway is located on Plate 6, Appendix E.

b. Location. The dam is located on Forest Hills Run in Paradise Township, Monroe County, Pennsylvania. The dam site is approximately one mile north of Swiftwater at Mount Airy Lodge, Pennsylvania. The dam site and reservoir are shown on USGS Quadrangle entitled "Mount Pocono, Pennsylvania" at coordinates N 41° 6.8' W 75° 19.2'. A regional location plan of Mount Airy Dam and lake is enclosed as Plate 1, Appendix E.

c. Size Classification. The dam is classified as an "Intermediate" structure by virtue of its 42-foot height.

d. Hazard Classification. A "High" hazard classification is assigned consistent with the potential for extensive property damage and loss of life within one mile downstream of the dam.

e. Ownership. Mount Airy Dam is owned and maintained by Mount Airy Lodges. All correspondence should be sent to Mr. Herman Martens, President, Mount Airy Lodges, Inc., Mount Pocono, Pennsylvania 18344.

f. Purpose of Dam. The purpose of the dam is to provide recreational facilities for Mount Airy Lodges.

g. Design and Construction History. Construction drawings and specifications were prepared by Burns & Loewe, Architects and Engineers of Scranton, Pennsylvania. The foundation analysis was prepared by Guyton Kempter & Associates of Delaware Water Gap, Pennsylvania. As special consultants to Guyton Kempter & Associates, Professor H. Y. Fang and Mr. C. E. Brewer of Lehigh University were engaged to perform the foundation analysis and design calculations for the embankment. The application to construct Mount Airy Dam was submitted on 9 July 1969, and the permit was issued on 12 January 1971. Magnotta & Son Contracting Company of Scranton, Pennsylvania, was the contractor and Burns & Loewe provided periodic inspection services. Construction work began in the



spring of 1971 and was completed in the fall of 1971. The official completion date is 31 October 1974.

Because of the desire of the downstream residents and the Pennsylvania Fish Commission to maintain the quality of Forest Hill Run for fishing, changes in the design of the intake tower were made. Other design changes were made during construction, which included lengthening the concrete discharge pipe with a corrugated metal pipe and addition of a stone headwall to accommodate the proposed golf course (now under construction). Also, the spillway discharge channel was realigned to accommodate the proposed golf course. A bridge was added over the spillway and the distance between the top of the dam and the spillway crest was adjusted to maintain the original five feet head on the weir. The drawings and visual inspection disclose that the distance between the discharge chute floor and the weir crest was increased 2.5 feet. Consequently, the constructed height of the dam was increased to accommodate these changes and the dam is now 42 feet high instead of the original 38 feet. Some adjustments to the embankment slopes were made, which resulted in the reduction of the crest from 18 feet to 10 feet.

Records submitted by Mr. J. Gibbons of Burns & Loewe indicate that the foundation was prepared in accordance with specifications, and that the fill was compacted to an average density of at least 95 percent of the standard proctor, as defined by AASHTO T-99. DER records confirm the quality of the construction.

h. Normal Operating Procedures. Under normal conditions, water is discharged through partially opened sluice gates in the intake tower, discharging through the 36-inch reinforced concrete pipe to the downstream toe. The permit requires a minimum discharge of 0.375 cfs or 242,500 gallons per day. During storm conditions, excess flow is discharged over the spillway at the right abutment.

The reservoir can be drained through the 36-inch sluice gate at the base of the tower. This water discharges through the common 36-inch pipe.

### 1.3 Pertinent Data.

Elevations on the drawings are based on an assumed datum of 2,000 feet, as shown on Plate 2, Appendix E. Elevations shown in parentheses are based on USGS datum, assuming the normal pool (spillway crest) elevation to be 1,170. A summary of pertinent data for Mount Airy Dam is presented as follows.

a.	Drainage Area (sq miles)	2.57
b.	Discharge at Dam Site (cfs)	
	Maximum Known Flood At Site	Unknown
	At Top of Dam (existing conditions)	3,635
c.	Elevation (feet above MSL)	
	Top of Dam (design)	1,996.0 (1,176.5)
	Low Point	1,995.2 (1,175.7)
	Spillway Crest	1,989.5 (1,170.0)
	Intake Tower	
	Top Inlet Gate (24 inch)	1,977.0 (1,157.5)
	Middle Inlet Gate (24 inch)	1,974.0 (1,154.5)
	Lower Inlet Gate (24 inch)	1,971.0 (1,151.5)
	Pond Drain Inlet (36 inch)	1,955.0 (1,135.5)
	Outlet Invert	1,953.0 (1,132.5)
d.	Reservoir (feet)	
	Length at Normal Pool	2,000
	Fetch at Normal Pool	1,300
e.	Storage (acre-feet)	
	Normal Pool (spillway crest)	187
	To Top of Dam (existing conditions)	284
f.	Reservoir Surface (acres)	
	Normal Pool	15.5
g.	Dam Data	
	Type	Zoned rolled earth fill.
	Length	700 ft
	Maximum Height	42± ft
	Top Width	10.5 ft
	Side Slope	
	Upstream	2.5H:1V
	Downstream	2H:1V
	Cutoff	Trench under centerline.
	Grout Curtain	None
h.	Intake Tower	
	Type	Concrete intake tower with three gates and a pond drain located upstream of crest at Sta. 4 + 97.

#### Intake Gates

Upper Gate	24 inch
Middle Gate	24 inch
Lower Gate	24 inch
Pond Drain	36 inch
RCP (outlet pipe)	36 inch

#### i. Spillway Type

Concrete trapezoidal weir with bridge over spillway supported by two piers.

#### Size

80 ft wide (less two 16-inch bridge piers)

#### Downstream Channel

Rock-lined channel discharging into natural stream.



## SECTION 2 ENGINEERING DATA

### 2.1 Design.

a. Data Available. A summary of engineering data for Mount Airy Dam is presented in the checklist attached as Appendix A. Principal documents containing pertinent data used for this report were made available by the Owner and the DER. Typical documents include the "Report Upon the Application of Mount Airy Lodges, Inc." by the DER, dated 17 September 1970, and the "Permit" prepared by the Commonwealth of Pennsylvania, DER, dated 12 January 1971. Other documents include an eight-sheet set of drawings prepared by Burns & Loewe, Architects/Engineers, Scranton, Pennsylvania, and the "Report On the Foundation Analysis" dated 24 November 1967, prepared by Guyton Kempter & Associates, Delaware Water Gap, Pennsylvania.

The available data, which was reconfirmed with the Owner and Engineer, was sufficient to evaluate the principal features of the dam and appurtenant structures. Selected portions of the drawings are included in Appendix E of this report.

b. Design Features. The principal design features are illustrated on the plan, profile and cross-section plates of the embankment and appurtenant structures that are enclosed in Appendix E as Plates 2 through 6. A complete description of the design features is presented in Section 1.2, "Description of Project".

### 2.2 Construction.

A description of the construction history is presented in Section 1.2.

### 2.3 Operational Data.

There are no operational or minimum flow records maintained. The minimum flow requirement is met by the partially opened sluice gates in the intake tower. There are no water level measurements or rainfall records maintained within this watershed.

## 2.4 Evaluation.

a. Availability. All engineering data produced in this report and studied for this investigation was provided by either the Pennsylvania DER or Mount Airy Lodges, Incorporated.

b. Adequacy. The data included in State files and supplemental data received from the Owner, Engineer and Contractor are considered to be adequate to evaluate the dam and appurtenant structures.

c. Validity. Some discrepancies were noted between the drawings and the field inspection observations. These discrepancies were discussed and confirmed with the Owner, Architect, DER and the Contractor.

### SECTION 3 VISUAL INSPECTION

#### 3.1 Findings.

a. General. The observations and comments of the field inspection team are contained in the checklist enclosed herein as Appendix B, and are summarized and evaluated as follows. In general, the dam and its appurtenant facilities are in good condition and well maintained.

b. Dam. During the visual inspection, there were no indications of distortion in alignment or grade that would be indicative of excessive movement of the embankment or foundation. Minor settlement of the embankment was noted adjacent to the left wall of the spillway. A profile along the dam crest indicates a low point (about six inches) some 20 feet left of the spillway. Also, the right abutment has a swale that is about ten inches lower than the top of the bridge deck.

Inspection of the downstream slope and the immediately adjacent downstream area disclosed no seepage. About 75 feet downstream of the embankment toe is a water hazard pond for the golf course. Clear seepage and ferric oxide staining were noted in the spillway discharge channel and at the outlet of the intake tower. See sheet 5a, Appendix B. It was not possible to determine the source of the seepage, but the small concentrated seeps are undesirable and should be monitored.

The drawings indicate that a toe drain outlets through the wing walls of the 36-inch pipe outlet structure. The headwall of the structure and the toe drain pipes were constructed; but shortly thereafter, the discharge pipe was extended ten feet with a corrugated metal pipe and a rock headwall was constructed. Seepage collected by the toe drain is discharged through this pipe, combining with the sluice gate discharge from the tower. Therefore, the seepage rates from the embankment drains could not be estimated. Ferric oxide stained material was also noted at the outlet.

The upstream riprap surface undulated showing signs of slight erosion. The quality of the rock was assessed to be very good. No indications of surface cracks were noted on the embankment crest or on the slopes. Some minor erosion was noted on the downstream slope. However, the slope had recently been seeded and the grass was not yet established.



c. Appurtenant Structures. At the time of inspection, water was just barely flowing over the spillway crest. The spillway weir, discharge channel floor and walls, bridge and the two bridge piers are in good condition. The downstream channel was also inspected and assessed to be stable.

The foot bridge leading to the intake tower and the exterior portions of the tower above the normal pool were inspected and observed to be in good condition. In addition, the interior of the tower was also inspected and assessed to be in good condition. One minor concrete crack was noted on the northwest wall of the tower above the sluice gate. The crack is minor, but should be patched during routine maintenance of the tower. As water was entering through the lower two sluice gates, the base of the tower and discharge pipe could not be inspected. These gates were fabricated by a local shop and it was noted that the valve stems were bent. The stems appeared to be undersized and/or insufficiently braced to allow for closing without buckling the rods.

d. Reservoir. Reconnaissance of the reservoir disclosed no evidence of significant siltation, slope instability or other features that would significantly affect the flood storage capacity of the reservoir. The reservoir slopes are stable and well vegetated, predominantly with grass and other mowed vegetation, in the vicinity of the reservoir.

e. Downstream Channel. As shown on Plate 1, Appendix E, Forest Hill Run discharges into Paradise Creek about three miles below the dam. There are a minimum of eight homes subject to damage in the event of dam failure.

The valley gradient is approximately 0.0178 with two to three foot high channel banks. The channel flows through a wooded area before entering Paradise Creek. Parts of the channel have been undercut and some trees have fallen across the channel.

### 3.2 Evaluation.

Inspection of the dam disclosed no evidence of apparent past or present movement that would indicate existing instability of the dam, spillway or the intake tower. Three low areas along the crest were observed adjacent to the left wall of the spillway, twenty feet left of the spillway, and at the right abutment of the dam. Although the pond drain gate and the other sluice gates were not exercised during inspection because of the bent stems, Mr. Krummel, representative



of Mount Airy Lodges, reports that these gates are periodical-ly exercised during the year. These gates were observed to be clean, painted and well lubricated. The interior portion of the tower was assessed to be in good condition, but the discharge pipe could not be inspected due to flow through the system. The spillway and discharge channel were inspected and observed to be in good condition.

The last bridge is the tower above the normal pool level. The exterior portion of the tower above the normal pool level is inspected and assessed to be in good condition. In addition, the interior of the tower was also inspected and assessed to be in good condition. One minor concrete crack was noted on the northeast wall of the tower above the sluice gate. The crack is about 1/2 inch wide and extends about 10 feet along the wall of the tower. As water was entering through the lower portion of the tower, the base of the tower and discharge pipe could not be inspected. These gates were lubricated by a local shop and it was noted that the valve stems were bent. The stems appeared to be unbalanced and/or insufficiently placed to allow for closing without jacking the rods.

5. Reservoir. The surroundings of the reservoir are closed to evidence of significant siltation. Slope instability or other features that would significantly affect the flood storage capacity of the reservoir. The reservoir slopes are stable and well vegetated, predominantly with grass and other mowed vegetation in the vicinity of the reservoir.

6. Downstream Channel. As shown on Plate 1, Appendix B, Forest Hill Dam discharges into Paradise Creek about three miles below the dam. There are a minimum of eight houses subject to damage in the event of dam failure.

The valley gradient is approximately 0.0175 with two to three foot high channel banks. The channel flows through a wooded area before entering Paradise Creek. Parts of the channel have been undercut and some trees have fallen across the channel.

#### 5.1 Evaluation

Inspection of the dam disclosed no evidence of apparent past or present movement that would indicate existing instability of the dam, spillway or the intake tower. Three low stone abutment crest were observed adjacent to the left wall of the spillway, twenty feet left of the spillway, and at the right abutment of the dam. Although the pond drain pipes and the other sluice gates were not exercised during inspection because of the bent stems, Mr. Kimmel, representative

## SECTION 4 OPERATIONAL PROCEDURES

### 4.1 Procedures.

Operational procedures are discussed in some detail in Section 1.2. Operation of the dam requires a dam tender only to adjust flow through the sluice gates to maintain the required flow downstream. Under normal conditions, all flow discharges through the sluice gates. Excess water is discharged through the emergency spillway. There are no formal written operation or maintenance procedures.

### 4.2 Maintenance of the Dam.

The dam is maintained by Mount Airy Lodges' staff, who periodically check and maintain the embankment and remove any debris.

### 4.3 Maintenance of Operating Facilities.

The sluice gates are lubricated, painted and operated by the staff of Mount Airy Lodges.

### 4.4 Warning Systems In Effect.

Representatives of Mount Airy Lodges reported that there are no formal warning systems or procedures established to be followed during periods of heavy rainfall. If hazardous conditions develop or if high flow conditions are anticipated, representatives of the Lodges would notify the police or Civil Defense authorities.

### 4.5 Evaluation.

It is judged that the current operating procedure, which requires only occasional adjustments of the sluice gate, is a realistic means of operating the relatively simple control facility at Mount Airy Dam. However, the operational procedure should be amended to document the discharge quantities in accordance with the "Permit" to insure that minimum flow requirements are met.

Since there are no formal warning procedures, it is recommended that a formal procedure be developed so that downstream residents would be amply warned of possible high flows or potentially hazardous conditions. In addition, a maintenance procedure and inspection checklist should be implemented and utilized to insure that the dam and its appurtenant facilities are maintained in the best possible condition.

#### 4.2 Maintenance of the Dam

The dam is maintained by Mount Airy Lodge staff who periodically check and maintain the embankment and remove any debris.

#### 4.3 Maintenance of Operating Facilities

The sluice gates are lubricated, painted and maintained by the staff of Mount Airy Lodge.

#### 4.4 Warning Systems in Effect

Representatives of Mount Airy Lodge reported that there are no formal warning systems or procedures established to be followed during periods of heavy rainfall. If hazardous conditions develop or if high flow conditions are anticipated, representatives of the Lodge would notify the police or Civil Defense authorities.

#### 4.5 Evaluation

It is judged that the current operating procedures which require only occasional adjustment of the sluice gate, is a realistic means of operating the relatively simple control facility at Mount Airy Dam. However, the operational procedures should be amended to document the discharge quantities in accordance with the "Permit" to ensure that minimum flow requirements are met.



## SECTION 5 HYDROLOGY/HYDRAULICS

### 5.1 Evaluation of Features.

a. Design Data. It is apparent from State files that design criteria for the spillway was to discharge not less than 2,950 cfs.

The watershed is small, about 3.1 miles long and 0.75 mile wide, having a total area of about 2.57 square miles. Elevations range from about 1,900 in the upper reaches to an estimated 1,170 at normal pool elevation. There are no significant ponds or marshy areas within the watershed. The watershed is about 95 percent wooded with 30 percent residential development, mainly in the Borough of Mount Pocono.

In accordance with the criteria established by the Federal (OCE) Guidelines, the recommended spillway design flood for this "Intermediate" size dam and "High" hazard potential classification is the Probable Maximum Flood (PMF).

b. Experience Data. No reservoir water level records or precipitation records are maintained. There is no estimate of previous high water levels.

c. Visual Observations. On the date of the inspection, there were no conditions observed that would indicate a reduced spillway capacity during a flood occurrence. However, a low point (six inches) in the embankment was noted about 20 feet left of the spillway and a swale was noted near the right abutment about ten inches lower than the top of the bridge deck. These two depressions would be the first points of overtopping. Observations regarding the condition of the downstream channel, spillway and reservoir are located in Appendix B.

d. Overtopping Potential. The overtopping potential of this dam was estimated using the "HEC-1, Dam Safety Version", computer program. A brief description of the program and a summary of the dam safety analysis are included in Appendix C. Calculations for this investigation estimate the spillway capacity to be about 3,525 cfs with the reservoir level at the underside of the bridge and 3,635 cfs when the reservoir level is at the low point of the right abutment. The HEC-1 program computed the peak PMF inflow to be 4,793 cfs. The spillway can pass approximately 77 percent of the PMF without overtopping under present conditions. The spillway could pass 82 percent of the PMF if the minimum

elevation of the embankment and abutment is the same as the deck of the bridge.

e. Spillway Adequacy. The spillway is considered to be "Inadequate" but not "Seriously Inadequate" as the dam will pass more than 50 percent of the PMF storm without overtopping the embankment.

f. Downstream Conditions. About 1.5 miles below the dam are four houses which would be destroyed in the event of dam failure. Within the next two miles downstream are six more homes built adjacent to the stream which would also be damaged. Forest Hill Run enters Paradise Creek about three miles below the dam.

Damage, including loss of life, would be significantly greater if the dam failed during the passing of the PMF than damage resulting from high flows if the dam did not fail during the PMF.

## SECTION 6 STRUCTURAL STABILITY

### 6.1 Evaluation of Structural Stability.

a. Visual Observations. Visual observations detected no evidence of existing or pending embankment stability problems. The upstream slope is quite stable and in good condition. Similarly, the vegetated downstream slope and asphalt paved crest were also assessed to be in good condition. There were no external signs or other evidence to indicate that the internal drainage systems were not operating properly. The toe drain outlets could not be inspected as they discharge inside the discharge pipe about 10 feet from the end and water was discharging through the pipe, preventing reasonable access.

No signs of seepage were observed at the downstream toe or in areas just beyond the toe. Clear seepage with ferric oxide staining was noted in the discharge channel downstream of the water hazard pond. This seepage should be monitored.

Exposed portions of the spillway were inspected and judged to be in good condition. The intake tower was also inspected and observed to be in good condition with the exception of the sluice gate stems, which appeared to be undersized and/or insufficiently supported.

b. Design and Construction Data. The "Foundations Analysis" report was in State files and was reviewed. The report indicates that a seepage evaluation was performed and includes a stability analysis for a proposed section with a maximum height of 35 feet. This is seven feet less than the actual height of the dam. The State waived additional stability evaluations for the final maximum section subsequent to their assessment of the calculations, embankment geometry and borrow materials. Also included in the report are results of laboratory testing on proposed borrow sources. Results indicate that available soils were well suited for use on the impervious core and shell, respectively. Construction data indicates that soil placement was performed in accordance with specifications.

c. Operating Records. There are no operational records for this structure.

d. Post-Construction Changes. The principal spillway pipe was extended with 10 feet of corrugated metal pipe, and a stone headwall was built to match the new downstream bridge.



e. **Seismic Stability.** The dam is located in Seismic Zone 1. Normally it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake conditions. Since results of the static stability analysis for the maximum section were not available, an assessment of the seismic stability for the maximum section of the dam is also unknown.



## SECTION 7 ASSESSMENT/REMEDIAL MEASURES

### 7.1 Dam Assessment.

a. Evaluation. Visual inspection and review of available documentation indicates that the embankment and appurtenant structures, with the exception of the sluice gate stems, are in generally good condition. Crest settlement was observed adjacent to the left spillway wall. There was also minor erosion on the downstream slope which was being stabilized with grass. Crest undulations were minor. The maximum differential crest variation was measured as 0.5 foot, and the right abutment is about 0.8 foot lower than the top of the bridge deck. The horizontal alignment of the crest is very good and the crest is covered with at least 3.5 inches of asphalt. The upstream riprap slope undulated showing signs of slight erosion, probably due to settlement and/or wave action.

There was no visible seepage through the downstream toe. Some clear seepage was noted beyond the water hazard pond and this seepage should be investigated to determine its source and affect on the dam. The toe drain outlets could not be inspected as they discharge inside the discharge pipe.

The spillway approach and discharge channels were inspected and found to be in good condition.

As previously mentioned, the intake tower was inspected and the only significant deficiency observed was the sluice gate stems. These stems have buckled and are in poor condition.

The hydrologic and hydraulic computations presented in Appendix C indicate that the dam under existing conditions will pass 77 percent of the Probable Maximum Flood without overtopping. Therefore, the spillway system of this structure is considered to be "Inadequate" but not "Seriously Inadequate".

b. Adequacy of Information. Information obtained for this Phase I Dam Inspection was sufficiently adequate to evaluate the structure.

c. Urgency. It is recommended that the suggestions presented in Section 7.2 be implemented as soon as possible.

## 7.2 Remedial Measures.

a. Facilities. It is recommended that the following measures be undertaken. These recommendations are presented in order of priority, but do not indicate that the latter recommendations are not important.

1. The mechanical operation of the sluice gate should be thoroughly checked by a professional engineer and appropriate measures taken to correct the situation with the stem.
2. As noted on sheet 6, Appendix B, under Emergency Gate, debris has apparently clogged this system. Appropriate measures should be taken to clear this gate in the event that it is necessary to drain the reservoir.
3. Toe drain discharge pipes should be inspected to confirm that they are functioning as designed.
4. The embankment crest and right abutment should be raised to an elevation at least equal to the top of the bridge deck.
5. Erosion of the downstream slopes should be monitored and, if it continues to occur, the area should be dressed, fertilized and reseeded.
6. As noted on sheet 6, Appendix B, a joint in the intake tower is leaking. This should be repaired.
7. The upstream riprap slope should be monitored for continued settlement of the rock. If this settlement and the associated undulation continues, necessary remedial measures should be taken.

b. Operation and Maintenance Procedures. Because of the location of the dam upstream from populated areas, a formal procedure of observation and warning during periods of high precipitation should be developed and implemented. This procedure should include a written method of how downstream residents would be warned.

The Owner should also develop an operation and maintenance procedure to be used to insure that the dam is operated in a safe manner and maintained in the best condition possible.

**APPENDIX**

**A**



NAME OF DAM Mount Airy Dam  
ID # PA 00811

CHECK LIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION  
PHASE I

Sheet 1 of 4

ITEM

REMARKS

AS-BUILT DRAWINGS

Only construction drawings available.  
See Appendix E.

REGIONAL VICINITY MAP

See Plate 1, Appendix E.

CONSTRUCTION HISTORY

Resident Engineer and DER Inspection Reports.

TYPICAL SECTIONS OF DAM

See Appendix E.

OUTLETS - PLAN

DETAILS

See Appendix E.

CONSTRAINTS

DISCHARGE RATINGS

See Appendix C.

RAINFALL/RESERVOIR RECORDS

None

ITEM	REMARKS
DESIGN REPORTS	Yes. One design report available entitled: <i>Foundation Analysis</i> ". See <i>Geology Reports</i> .
GEOLOGY REPORTS	Yes. " <i>Foundation Analysis</i> " by Guyton Kempter and Associates, Delaware Water Gap, Pennsylvania, using Prof. H.Y. Fang and C.E. Brewer as consultants.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	See <i>Geology Report</i> , above. See <i>Geology Report</i> , above.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	See <i>Geology Report</i> , above.
POST-CONSTRUCTION SURVEYS OF DAM	None known.
BORROW SOURCES	Discussed in " <i>Foundation Analysis Report</i> ", see <i>Geology Reports</i> , above.

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	None known after construction.
HIGH POOL RECORDS	None
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	None

ITEM	REMARKS
SPILLWAY PLAN	See Appendix E.
SECTIONS DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	See Appendix E.
MISCELLANEOUS	<ol style="list-style-type: none"> <li>1. "Permit" issued 12 January, 1971 by Maurice K. Goddard, Water and Power Resources Board</li> <li>2. "Application" filed 9 July, 1969</li> <li>3. "Construction Specifications" by Burns and Loewe, Scranton, Penna.</li> <li>4. "Hearings" December 22, 1970, Harrisburg, Pennsylvania</li> <li>5. "Report Upon the Application of Mount Airy Lodge" September 17, 1970</li> <li>6. Resident Engineer Reports to Water &amp; Power Resources Board, Harrisburg, Pennsylvania</li> </ol>



**APPENDIX**

**B**

CHECK LIST  
VISUAL INSPECTION  
PHASE I

Sheet 1 of 11

Name Dam Mount Airy Dam County Monroe State Pennsylvania National ID # PA 00811  
Type of Dam Earth Hazard Category I (High)  
Date(s) Inspection 6 Nov. 78 Weather Clear & Cool Temperature 50's

Pool Elevation at Time of Inspection 1170± M.S.L. Tailwater at Time of Inspection N/A M.S.L.

Inspection Personnel:

Mary Beck (Hydrologist) Raymond Lambert (Geologist) John H. Frederick, Jr. (Geotechnical)  
John Boschuk, Jr. (Geotechnical) Vincent McKeever (Hydrologist)

John Boschuk, Jr. Recorder

Remarks:

Messrs. Herman Martens and William Krummel were on site and provided assistance  
to the inspection team.

# CONCRETE/MASONRY DAMS

Sheet 2 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	N/A	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
DRAINS	N/A	
WATER PASSAGES	N/A	
FOUNDATION	N/A	



CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N/A	
STRUCTURAL CRACKING	N/A	
VERTICAL AND HORIZONTAL ALIGNMENT	N/A	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	

EMBANKMENT

Sheet 4 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

SURFACE CRACKS	None observed.	
----------------	----------------	--

UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
---	----------------	--

SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Minor erosion has occurred on the downstream slope but has since stabilized with grass.	
--	--	--

VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The crest undulates with variations up to 0.5 feet. The horizontal alignment is good and the crest is covered with at least 3-1/2 inches of asphalt and is stable.	
---	--	--

RIPRAP FAILURES	The upstream riprap slope undulates with signs of erosion probably due to settlement and/or wave action. This condition should be monitored and corrected as necessary to minimize degradation of the slope.	
-----------------	---	--

EMBANKMENT

Sheet 5 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

JUNCTION OF EMBANKMENT  
AND ABUTMENT, SPILLWAY  
AND DAM

*The condition of the junction is good. There are no significant signs of undesirable erosion or degradation.*

ANY NOTICEABLE SEEPAGE

*None observed.*

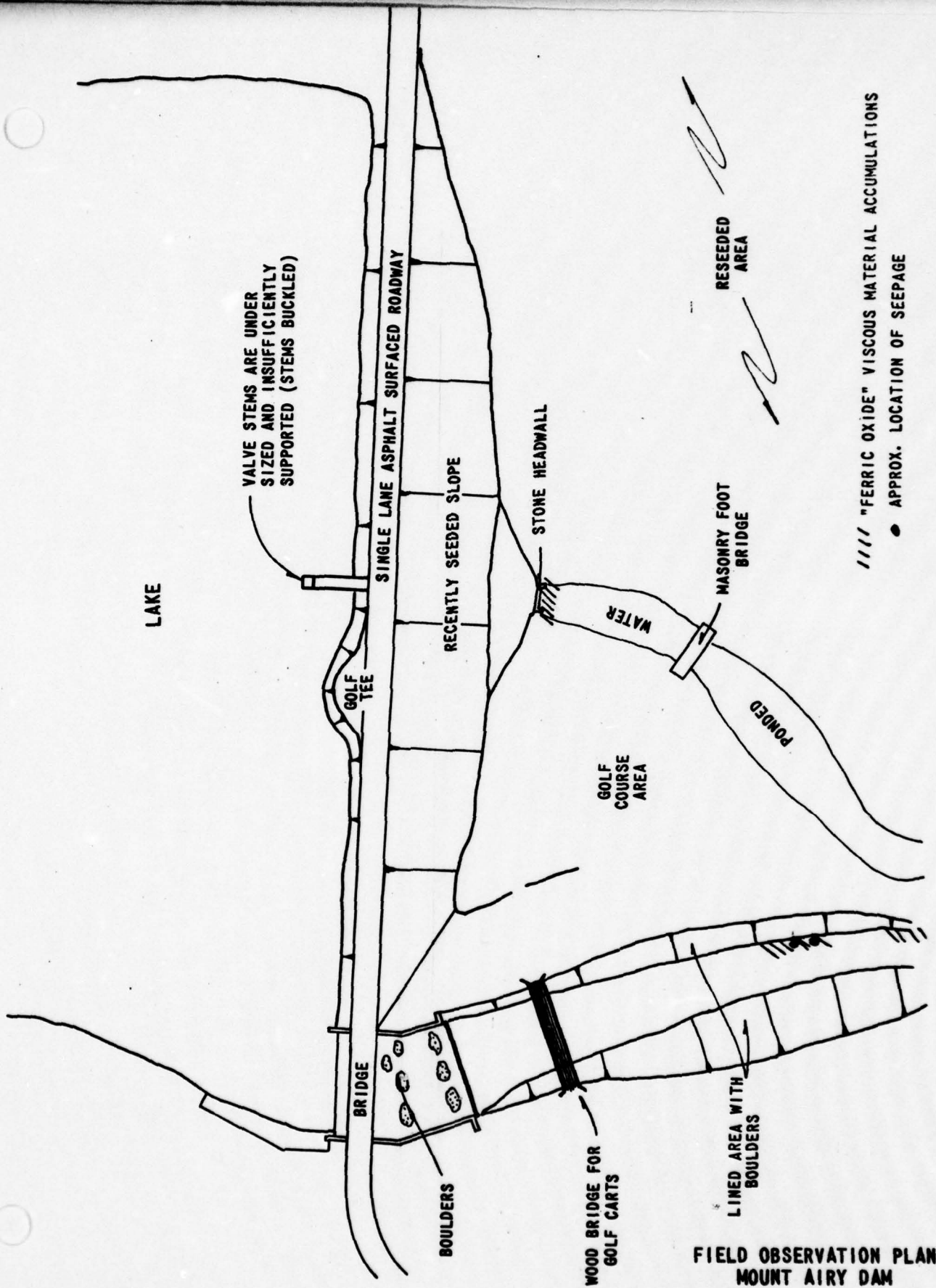
STAFF GAGE AND RECORDER

*None*

DRAINS

*Could not see embankment drainage system as they outletted through the wing walls of the outlet structure which since has been buried, see next sheet.*





FIELD OBSERVATION PLAN  
MOUNT AIRY DAM

SHEET 5a OF 11

OUTLET WORKS

Sheet 6 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None observed. It is noted that the principal spillway pipe was extended with corrugated metal.	
INTAKE STRUCTURE	Good condition except for a minor joint leak through the concrete about halfway down the tower on the left upstream side. This should be repaired.	
OUTLET STRUCTURE	Good condition, the original concrete outlet was covered with soil when the 10 feet of CMP and stone head wall was added.	
OUTLET CHANNEL	Good condition.	
EMERGENCY GATE	The gate was not exercised because the caretaker indicated that debris at the lake bottom would probably clog the gate.	

UNGATED SPILLWAY

Sheet 7 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

CONCRETE WEIR	Good condition.	
---------------	-----------------	--

APPROACH CHANNEL	Good condition.	
------------------	-----------------	--

DISCHARGE CHANNEL	Good condition.	
-------------------	-----------------	--

BRIDGE AND PIERS	Good condition.	
------------------	-----------------	--



GATED SPILLWAY

Sheet 8 of 11

VISUAL EXAMINATION OF		OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL		None	
APPROACH CHANNEL		None	
DISCHARGE CHANNEL		None	
BRIDGE AND PIERS		None	
GATES AND OPERATION EQUIPMENT		None	

INSTRUMENTATION

Sheet 9 of 11

<u>VISUAL EXAMINATION</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
---------------------------	---------------------	-----------------------------------

MONUMENTATION/SURVEYS	None	
-----------------------	------	--

OBSERVATION WELLS	None	
-------------------	------	--

WEIRS	None	
-------	------	--

PIEZOMETERS	None	
-------------	------	--

OTHER	None	
-------	------	--

RESERVOIR

Sheet 10 of 11

VISUAL EXAMINATION OF OBSERVATIONS REMARKS OR RECOMMENDATIONS

SLOPES

Moderate slopes, well vegetated with grass (golf course).

SEDIMENTATION

Some gravel is being deposited at upper end of the reservoir which has no measurable affect on the available flood storage.



DOWNSTREAM CHANNEL

Sheet 11 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	<i>Channel immediately downstream of the dam recently relocated around expanded golf course area. Downstream of the golf course, the channel flows through a wooded flood plain with light underbrush. The channel banks are vertical, two to three feet high, with some undercutting. Some trees have fallen across the channel.</i>	
SLOPES	<i>The valley gradient is approximately 0.0178.</i>	
APPROXIMATE NO. OF HOMES AND POPULATION	<i>Approximately 1.5 miles downstream of the dam, four houses are built in the flood plain which would be subject to damage in the event the dam failed. Five or more houses are built at a somewhat higher elevation which may be subject to flooding in the event of failure.</i>	

**APPENDIX**

**C**

MOUNT AIRY DAM  
CHECK LIST  
HYDROLOGIC AND HYDRAULIC  
ENGINEERING DATA

Sheet 1 of 8

DRAINAGE AREA CHARACTERISTICS: 95% wooded with 30% residential.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1170\* feet (187 Acre-Feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1175.7 ft. (284 Acre-Feet)

ELEVATION MAXIMUM DESIGN POOL: -----

ELEVATION TOP DAM: 1175.7 feet, low point of right abutment.

SPILLWAY

a. Elevation 1170 feet.

b. Type Concrete weir.

c. Width 80 feet less two 16-inch thick bridge piers.

d. Length -----

e. Location Spillover Right abutment.

f. Number and Type of Gates None.

OUTLET WORKS:

a. Type Intake tower.

b. Location Upstream toe at Station 4 + 97,

c. Entrance inverts 1157.5 feet, 1154.5 feet, 1151.5 feet.

d. Exit inverts 1132.5 feet.

e. Emergency draindown facilities 36-inch pond drain at 1135.5 feet.

HYDROMETEOROLOGICAL GAGES:

a. Type None.

b. Location N/A

c. Records N/A

MAXIMUM NON-DAMAGING DISCHARGE: -----

*\*Assumed from USGS Map, all other elevations based on this.*



HEC-1, REVISED  
FLOOD HYDROGRAPH PACKAGE

The original "Flood Hydrograph Package" (HEC-1), developed by the Hydrologic Engineering Center, Corps of Engineers, has been modified for use under the National Dam Inspection Program. The "Flood Hydrograph Package (HEC-1), Dam Safety Version", hereinafter referred to as, HEC-1, Rev., has been modified to require less detailed input and to include a dam breach analysis. The required input is obtained from the field inspection of a dam, any available design/evaluation data, relatively simple hydraulic calculations, or information from the USGS Quandrangle maps. The input format is flexible in order to reflect any unique characteristics of an individual dam.

HEC-1, Rev. computes a reservoir inflow hydrograph based on individual watershed characteristics such as: area, percentage of impervious surface area, watershed shape, and hydrograph characteristics determined from regional correlation studies by the Corps of Engineers, Baltimore District. The inflow is routed through the reservoir using spillway discharge data obtained from the field inspection or design data. Flood storage capacity is determined from USGS maps or design information and verified by the field inspection. In the event a spillway cannot discharge 0.5 PMF without overtopping and failure of the dam, downstream channel characteristics obtained from the field inspection and USGS maps are inputted and flows are routed downstream to the damage center and a dam breach analysis is performed.

Included in this Appendix are the HEC-1, Rev. pertinent input values and a summary print-out tables.

### Classification (Ref. - Recommended Guidelines for Safety Inspection of Dams)

1. The hazard potential is rated as "High" as there would be loss of life if the dam failed. ✓
2. The size classification is "Intermediate" based on its 42-foot height. ✓
3. The spillway design flood, based on size and hazard classification is the Probable Maximum Flood (PMF). ✓

### Hydrology and Hydraulic Analysis

1. Design data. From information located in the State files, it is apparent that the spillway design criteria was the "C" curve established by the Water and Power Resources Board; ie,  $Q_{min} = 29.50 \text{ cfs}$  for 2.5 sq. mile watershed.
2. Evaluation of present structure was by the use of the computer program. Computer input data as follows:

#### Inflow hydrograph

rainfall - ref. Hydrometeorological Report No. 33 ✓  
 Snyder's hydrograph parameters,  $t_p \& C_p$  ✓  
 $t_p = C_t (L L_{ca})^{0.3}$

$C_t = 1.23$  } Information received from Corps of  
 $C_p = 0.45$  } Engineers, Baltimore District for  
 Zone 1

$L = 4.09$  miles from USGS ✓

$L_{ca} = 1.75$  miles map ✓

$$t_p = 1.23 (4.09 \cdot 1.75)^{0.3} = 2.22 \quad \checkmark$$

#### Reservoir routing

elevation-storage data, shown on sheet 7  
 taken from design drawings

BY MFB DATE 3/13/79 SUBJECT \_\_\_\_\_ SHEET 4 OF 8  
 CHKD. BY [Signature] DATE REV. 11/6/79 Mount Airy Dam JOB No. \_\_\_\_\_  
Hydrology / Hydraulics

elevation-discharge data, shown on sheet 7

$$Q = CLH^{3/2} \text{ assuming constant } C \text{ for heads up to } 5.17' \text{ (field checked)}$$

$C = 3.9$ , a minimum value estimated from Table 5-11, King & Brater, Handbook of Hydraulics

$$L = 80' - 2 \cdot 1.33 = 77.3' \text{ (field checked)}$$

$$Q = CA\sqrt{2gDH} \text{ for } 5.17' < H \leq 6.5'$$

$C = 0.8$  (assumed) [SCS-NEH-14]

$A = 5.17' \times 77.3'$

$DH$  = dist. between water surface and critical depth over weir

$$Q = 3800 \text{ cfs for } H > 6.5'$$

Overtopping potential - as shown on sheet 8, the spillway discharges about 0.77 PMF under existing conditions.

Spillway adequacy - the spillway is rated as "Inadequate" but not "Seriously Inadequate".



MFB

3/15/79

4/3/79

Mount Airy Dam  
Hydrology / Hydraulics

SH. 5 OF 8

1\*\*\*\*\*  
 FLOOD HYDROGRAPH PACKAGE (HEC-1)  
 DAN SAFETY VERSION JULY 1978  
 LAST MODIFICATION 26 FEB 79  
 \*\*\*\*\*

MOUNT AIRY DAM  
 NAT ID NO. PA 00811 DER NO. 45-243  
 OVERTOPPING POTENTIAL

JOB SPECIFICATION									
NQ	MHR	NMIN	IDAY	IHR	IMIN	METC	IPLT	IPRT	NSTAN
150	0	15	0	0	0	0	0	-4	0
			JOPER	NUT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED  
 NPLAN= 1 NRTIO= 5 LRTIO= 1  
 RTIOS= .60 .70 .80 .90 1.00

MFB 3/15/79

Mount Airy Dam  
Hydrology / Hydraulics

SH. 6 OF 8

# SUB-AREA RUNOFF COMPUTATION

## INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
IN	0	0	0	0	0	1	0	0

## HYDROGRAPH DATA

INYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	2.57	0.00	2.57	0.00	0.000	0	1	0

## PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.00	111.00	124.00	134.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

## LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

## UNIT HYDROGRAPH DATA

TP= 2.22 CP= .45 NTA= 0

## RECESSION DATA

STRTQ= -1.50 QRCNSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 81 END-OF-PERIOD ORDINATES, LAG= 2.23 HOURS, CP= .45 VOL= 1.00

11.	43.	87.	140.	198.	252.	296.	327.	341.	334.
313.	292.	272.	253.	236.	220.	205.	191.	178.	166.
155.	144.	134.	125.	117.	109.	101.	95.	88.	82.
77.	71.	66.	62.	58.	54.	50.	47.	44.	41.
38.	35.	33.	31.	29.	27.	25.	23.	22.	20.
19.	17.	16.	15.	14.	13.	12.	11.	11.	10.
9.	9.	8.	7.	7.	7.	6.	6.	5.	5.
5.	4.	4.	4.	3.	3.	3.	3.	3.	2.
2.									

## END-OF-PERIOD FLOW

NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
-------	-------	--------	------	------	------	--------	-------	-------	--------	------	------	------	--------

SUM 24.99 22.62 2.37 130961.  
( 635.)( 575.)( 60.)( 3708.40)

MFB  
CJH

3/15/79  
Rev 4/18/79

# Mount Airy Dam Hydrology / Hydraulics

CH. 7 OF 8

## HYDROGRAPH ROUTING

### OUTFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
OUT	1	0	0	0	0	1	0	0
ROUTING DATA								
QLOSS	CLOSS	AVG	IRRES	ISAME	IOPT	IPHP	LSTR	
0.0	0.000	0.00	1	1	0	0	0	
NSTPS NSTDL								
1	0	LAG	ANSK	X	TSK	STORA	ISPRAT	
		0	0.000	0.000	0.000	-1170.	-1	
STAGE	1170.00	1171.00	1172.00	1173.00	1174.00	1175.17	1176.50	1178.00
FLOW	0.00	286.00	809.00	1486.00	2288.00	3362.00	3800.00	3800.00

CAPACITY= 187. 357. 467.

ELEVATION= 1170. 1180. 1985.

CREL	SPWID	COBW	EXPV	ELEV	COBL	CAREA	EXPL
1170.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

### DAM DATA

TOPEL	COORD	EXPD	DAMWID
1175.7	0.0	0.0	0.

CREST LENGTH	0.	25.	125.	340.	430.	760.
AT OR BELOW						
ELEVATION	1175.7	1176.0	1176.5	1177.2	1177.3	1177.6

PEAK OUTFLOW IS 2855. AT TIME 42.25 HOURS

PEAK OUTFLOW IS 3331. AT TIME 42.25 HOURS

PEAK OUTFLOW IS 3732. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 4250. AT TIME 42.25 HOURS

PEAK OUTFLOW IS 4786. AT TIME 42.00 HOURS



3/15/79  
200. 4/18/79

Mount Airy Dam  
Hydrology / Hydraulics

SN. 8 OF 8

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS  
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)  
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS					
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	
HYDROGRAPH AT	IN	2.57	1	2876.	3355.	3834.	4314.	4793.	
	(	6.66)	(	81.43)	95.01)	108.58)	122.15)	135.72)	
ROUTED TO	OUT	2.57	1	2855.	3331.	3732.	4250.	4786.	
	(	6.66)	(	80.84)	94.32)	105.68)	120.35)	135.54)	

## SUMMARY OF DAM SAFETY ANALYSIS

RATIO OF PHF	MAXIMUM RESERVOIR U.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS	ELEVATION STORAGE OUTFLOW	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
.60	1174.62	0.00	265.	2855.	0.00	42.25	0.00		1170.00	1170.00	1175.70
.70	1175.14	0.00	274.	3031.	0.00	42.25	0.00		187.	187.	284.
.80	1176.22	.52	273.	3732.	1.75	42.50	0.00		0.	0.	3537.
.90	1177.10	1.40	307.	4250.	2.75	42.25	0.00				
1.00	1177.49	1.79	314.	4786.	3.75	42.00	0.00				

MFB 4/10/79

# Mount Airy Dam Hydrology/Hydraulics

CH. 8A of 8

*Over-topping Potential with Minimum Crest/Abutment Elevation  
Same As Top of Bridge - 1176.50.*

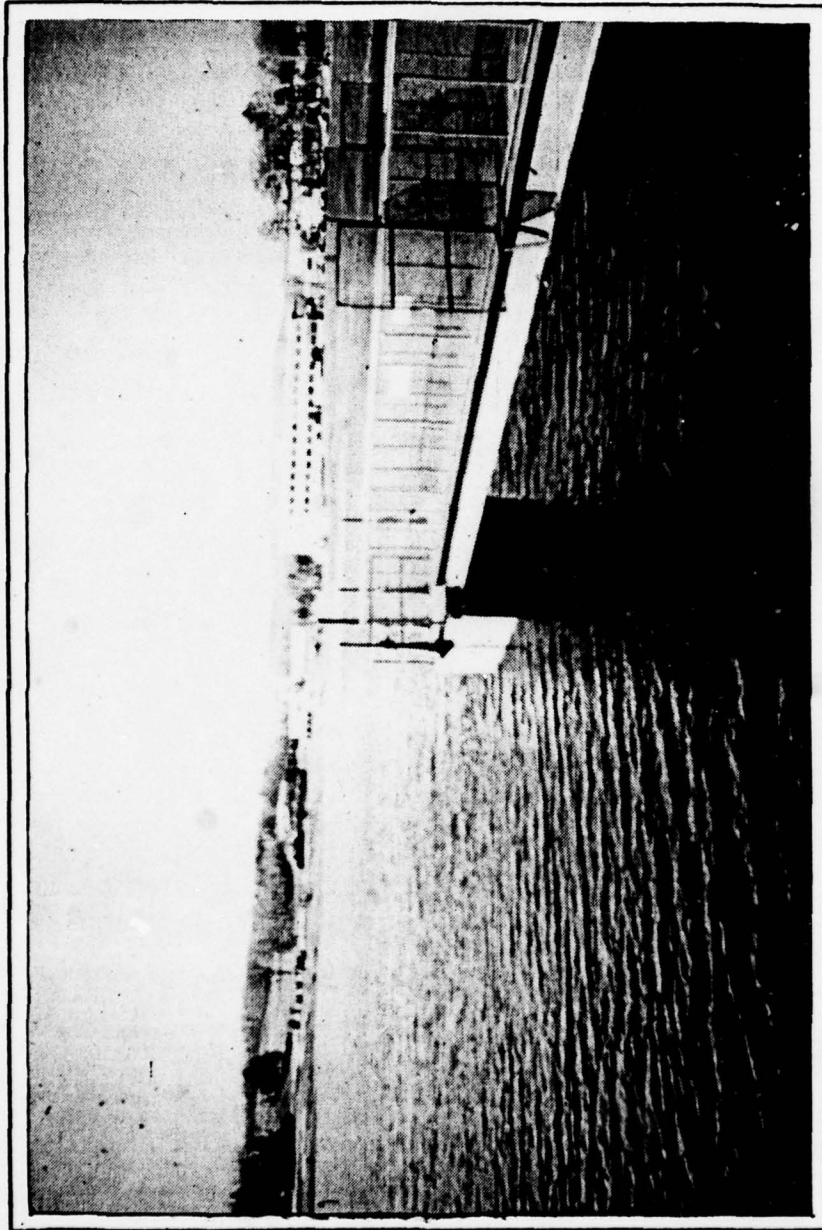
## SUMMARY OF DAM SAFETY ANALYSIS

RATIO OF PHF	MAXIMUM RESERVOIR U.S. ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
			INITIAL VALUE	SPILLWAY CREST		TOP OF DAM	
	ELEVATION		1170.00	1170.00		1176.50 ✓	
	STORAGE		187.	187.		297.	
	OUTFLOW		0.	0.		3800. ✓	
.60	1174.62	0.00	265.	2855.	0.00	42.25	0.00
.70	1175.14	0.00	274.	3331.	0.00	42.25	0.00
.80	1176.25	0.00	293.	3719.	0.00	42.50	0.00
.90	1177.27	.77	310.	4251.	2.00	42.25	0.00
1.00	1177.60	1.10	316.	4795.	2.75	42.00	0.00

**APPENDIX**

**D**



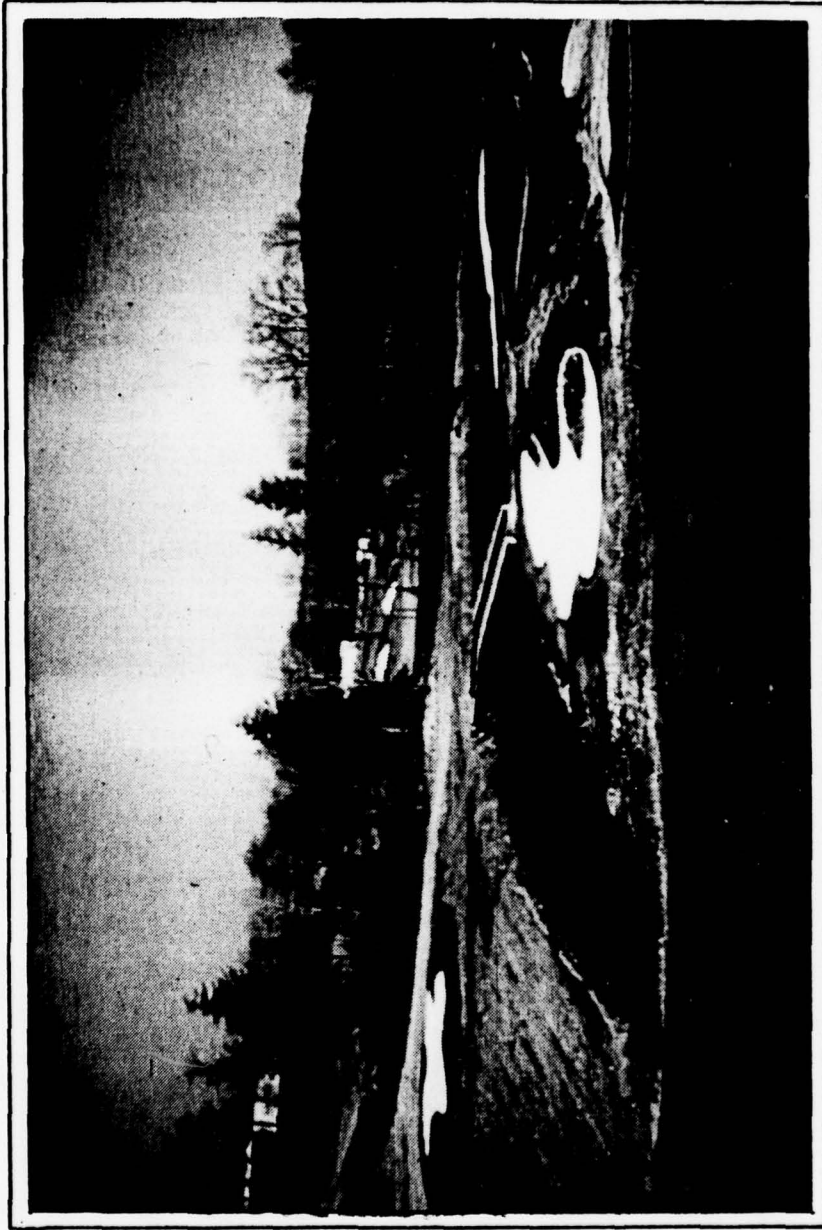


VIEW OF INTAKE TOWER AND FOOT BRIDGE  
CONNECTING DAM CREST TO THE TOWER.

PHOTOGRAPH NO. 1



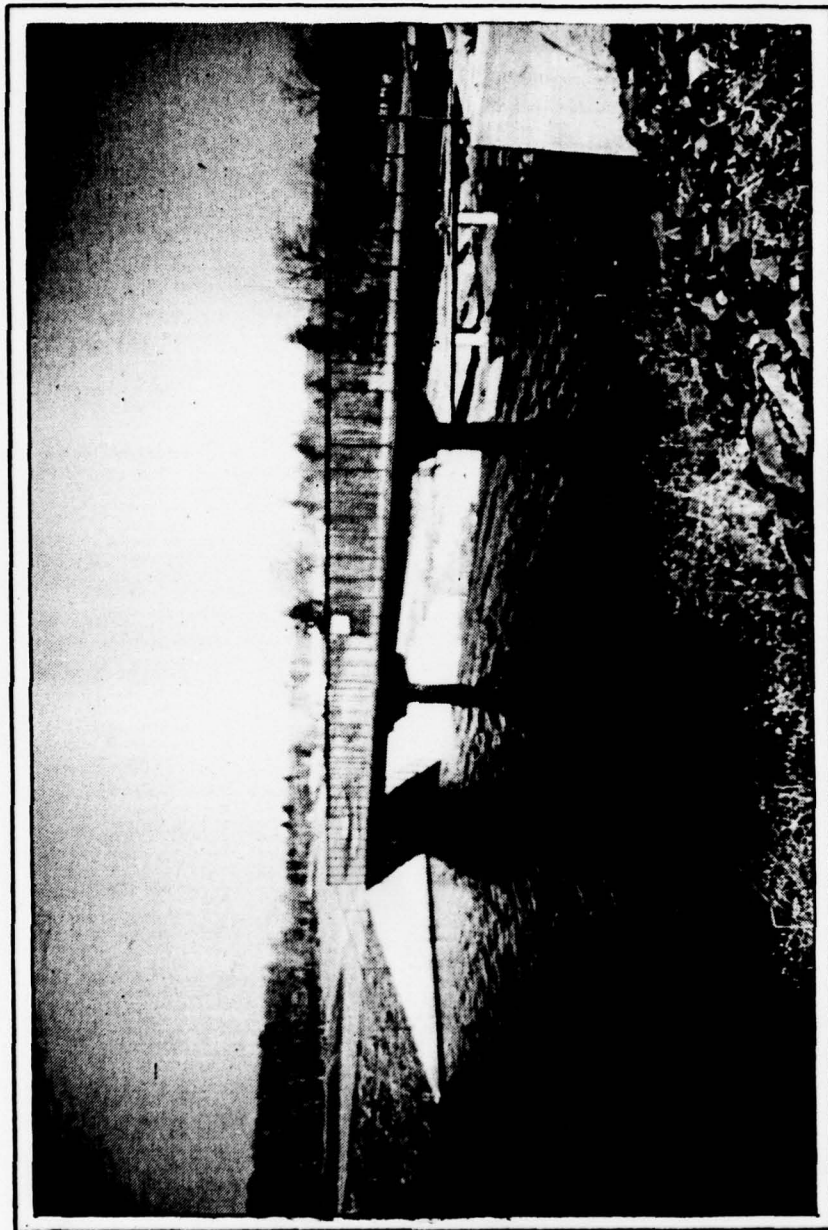
DISCHARGE CONDUIT AT TOE OF DAM.  
INTAKE TOWER INFLOW DISCHARGES  
THROUGH THIS CONDUIT.



OVERVIEW FROM DAM CREST LOOKING AT  
PRINCIPAL SPILLWAY DISCHARGE CHANNEL.

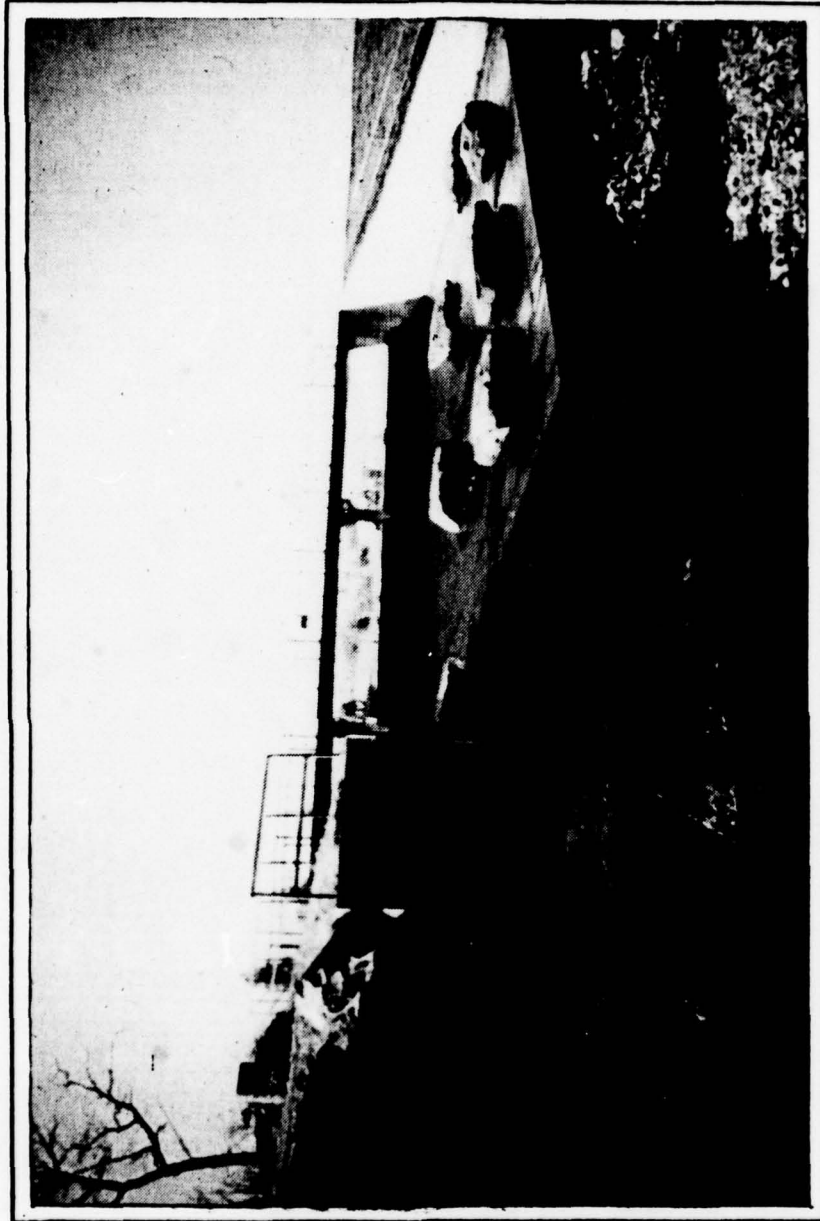
PHOTOGRAPH NO. 3





OVERVIEW FROM RIGHT ABUTMENT LOOKING  
AT APPROACH CHANNEL TO EMERGENCY  
SPILLWAY.

PHOTOGRAPH NO. 4



DISCHARGE CHANNEL OF EMERGENCY  
SPILLWAY. ROCKS IN THE CHANNEL  
WERE PLACED SOLELY FOR DECORATIVE  
PURPOSES.

PHOTOGRAPH NO. 5



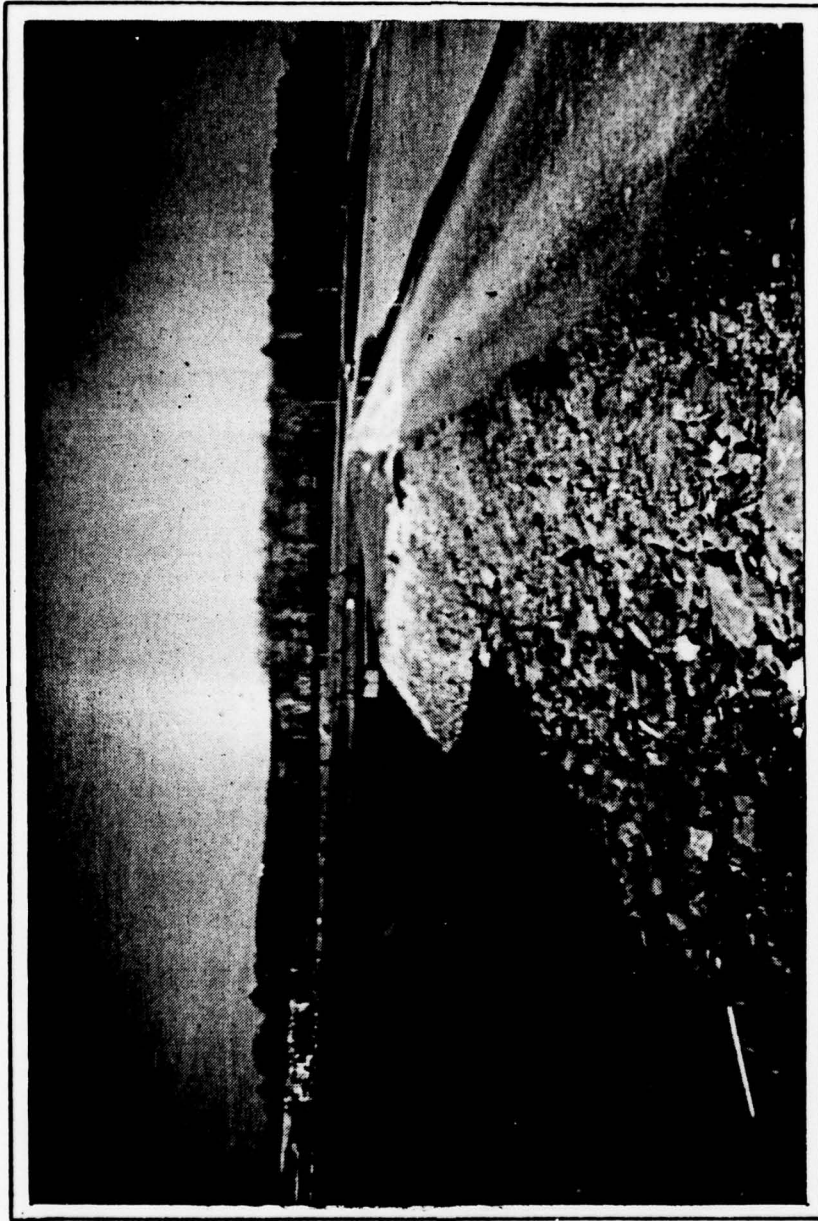
VIEW FROM BRIDGE ACROSS EMERGENCY  
SPILLWAY LOOKING DOWNSTREAM.





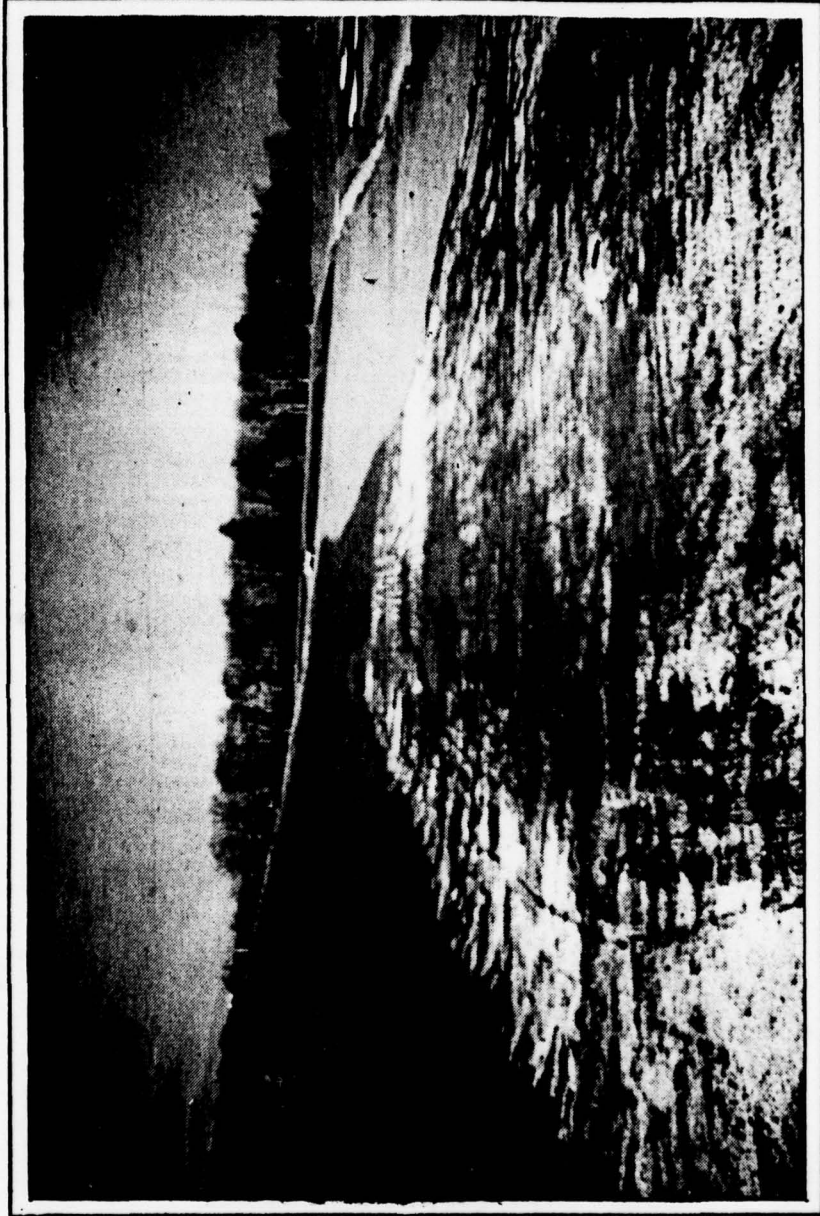
VIEW OF UPSTREAM RIPRAP LOOKING  
TOWARDS LEFT ABUTMENT.

PHOTOGRAPH NO. 7



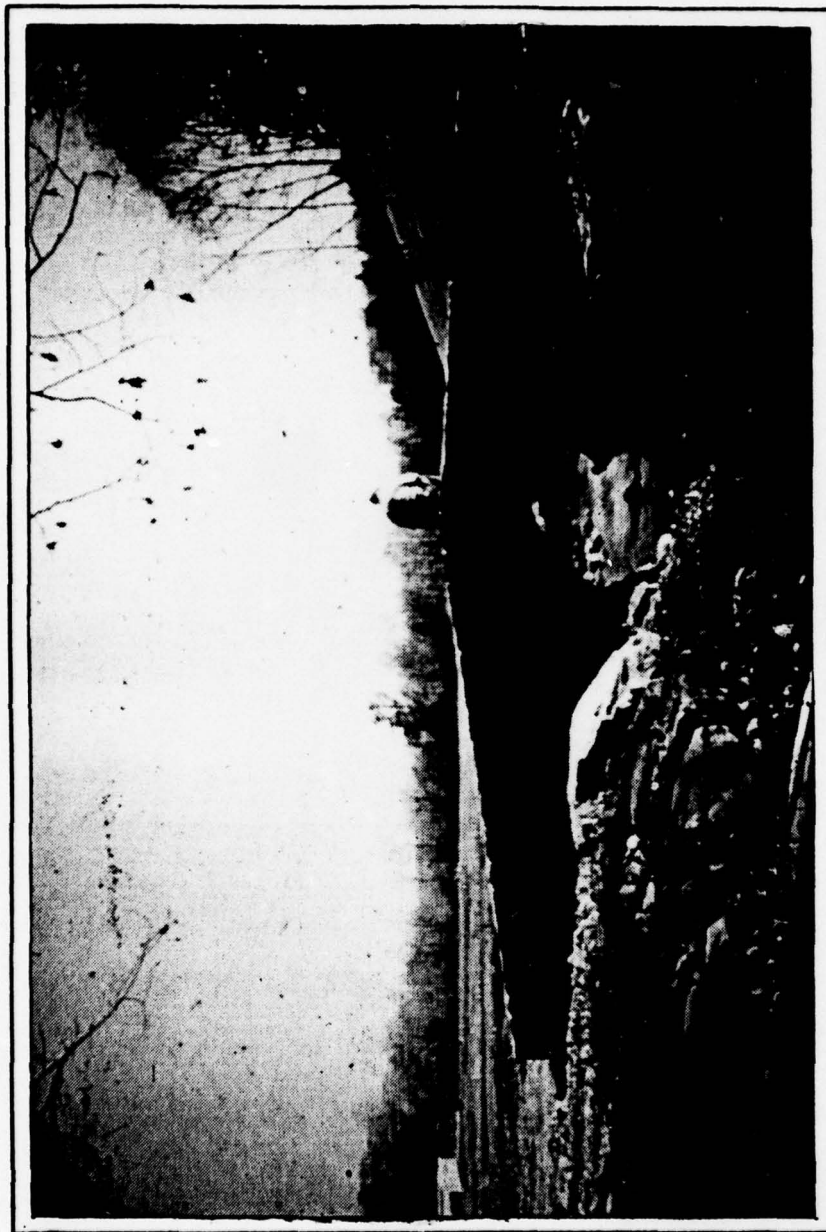
VIEW OF DAM CREST LOOKING FROM  
EMERGENCY SPILLWAY TOWARDS LEFT  
ABUTMENT. BULGE IN UPSTREAM  
SLOPE IS A GOLF TEE.

PHOTOGRAPH NO. 8



VIEW OF DOWNSTREAM SLOPE. AREA  
WAS RECENTLY SEEDED WITH GRASS.





VIEW OF DOWNSTREAM CHANNEL JUST  
BEYOND WHERE THE PRINCIPAL AND  
EMERGENCY CHANNELS CONVERGE.

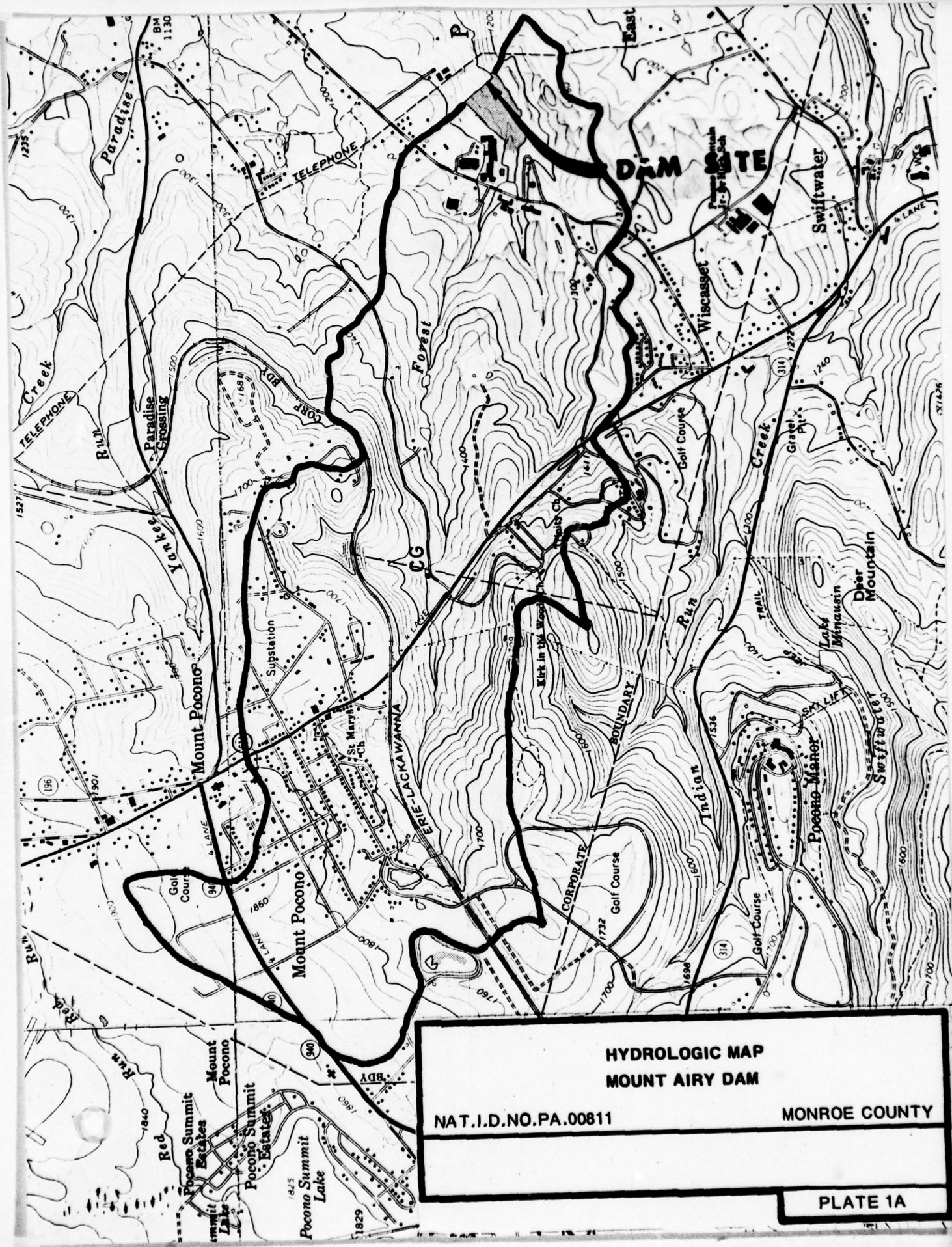
PHOTOGRAPH NO. 10

**APPENDIX**

**E**





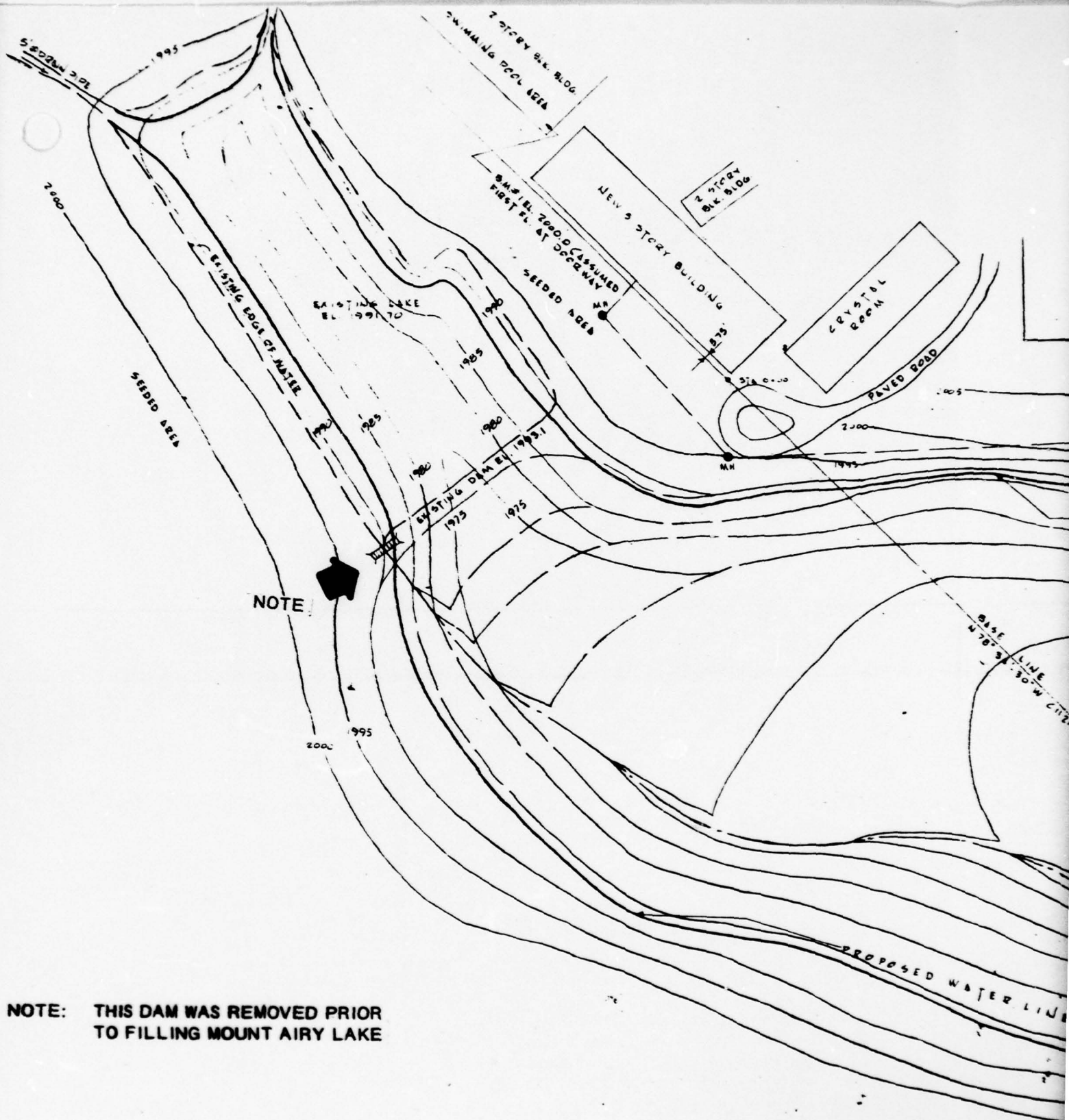


**HYDROLOGIC MAP  
MOUNT AIRY DAM**

NAT. I.D. NO. PA.00811

MONROE COUNTY

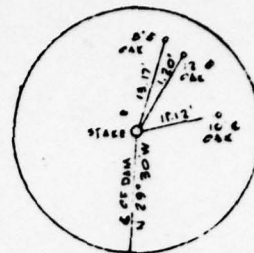
PLATE 1A



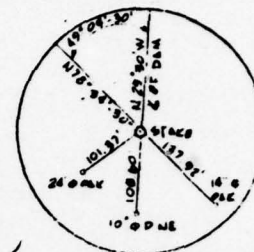
**NOTE: THIS DAM WAS REMOVED PRIOR  
TO FILLING MOUNT AIRY LAKE**

## SITE PLAN

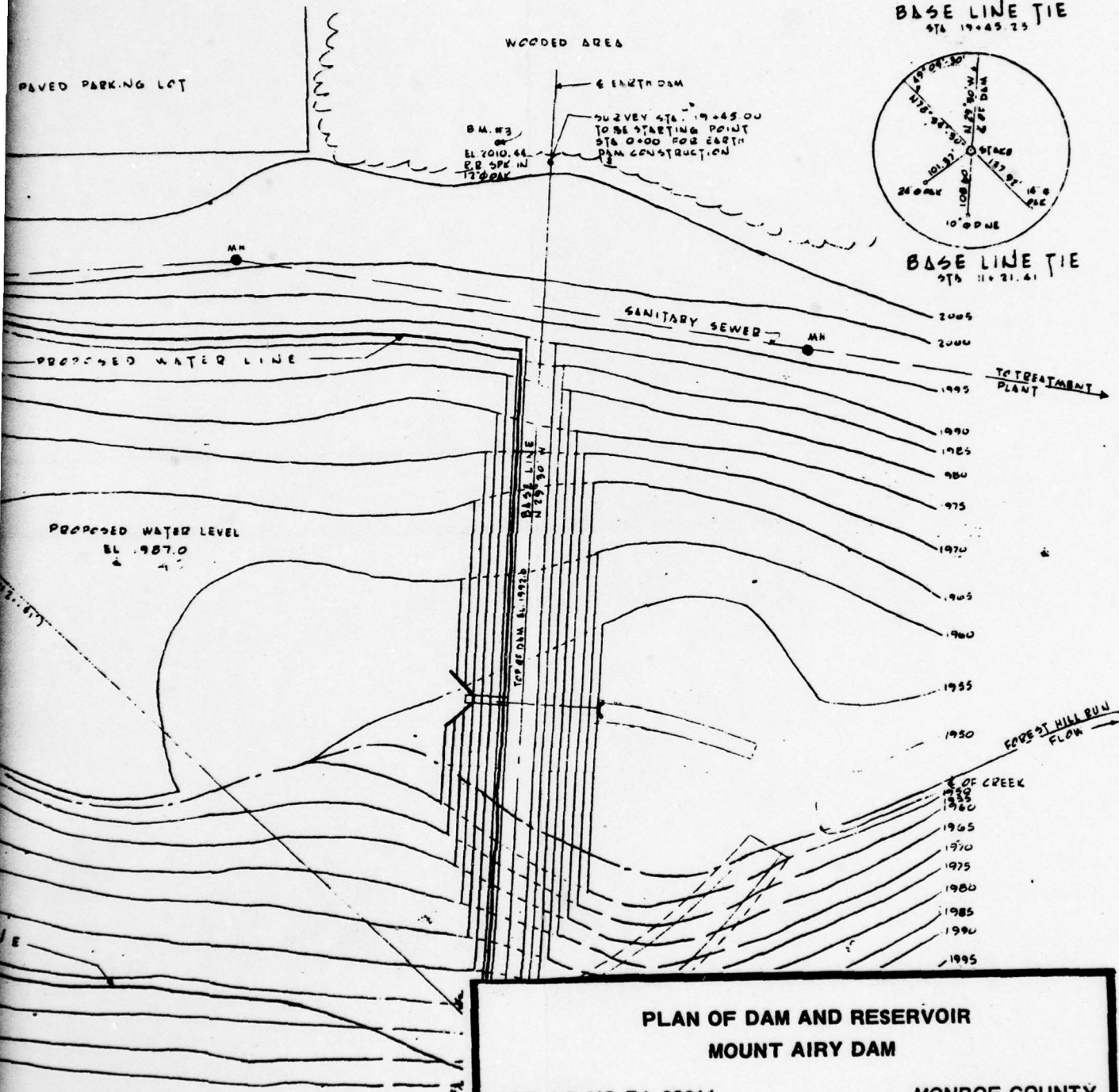




BASE LINE TIE  
STA 17+45.25



BASE LINE TIE  
STA 11+21.41



**PLAN OF DAM AND RESERVOIR**  
**MOUNT AIRY DAM**

NAT. I.D.NO.PA.00811

MONROE COUNTY

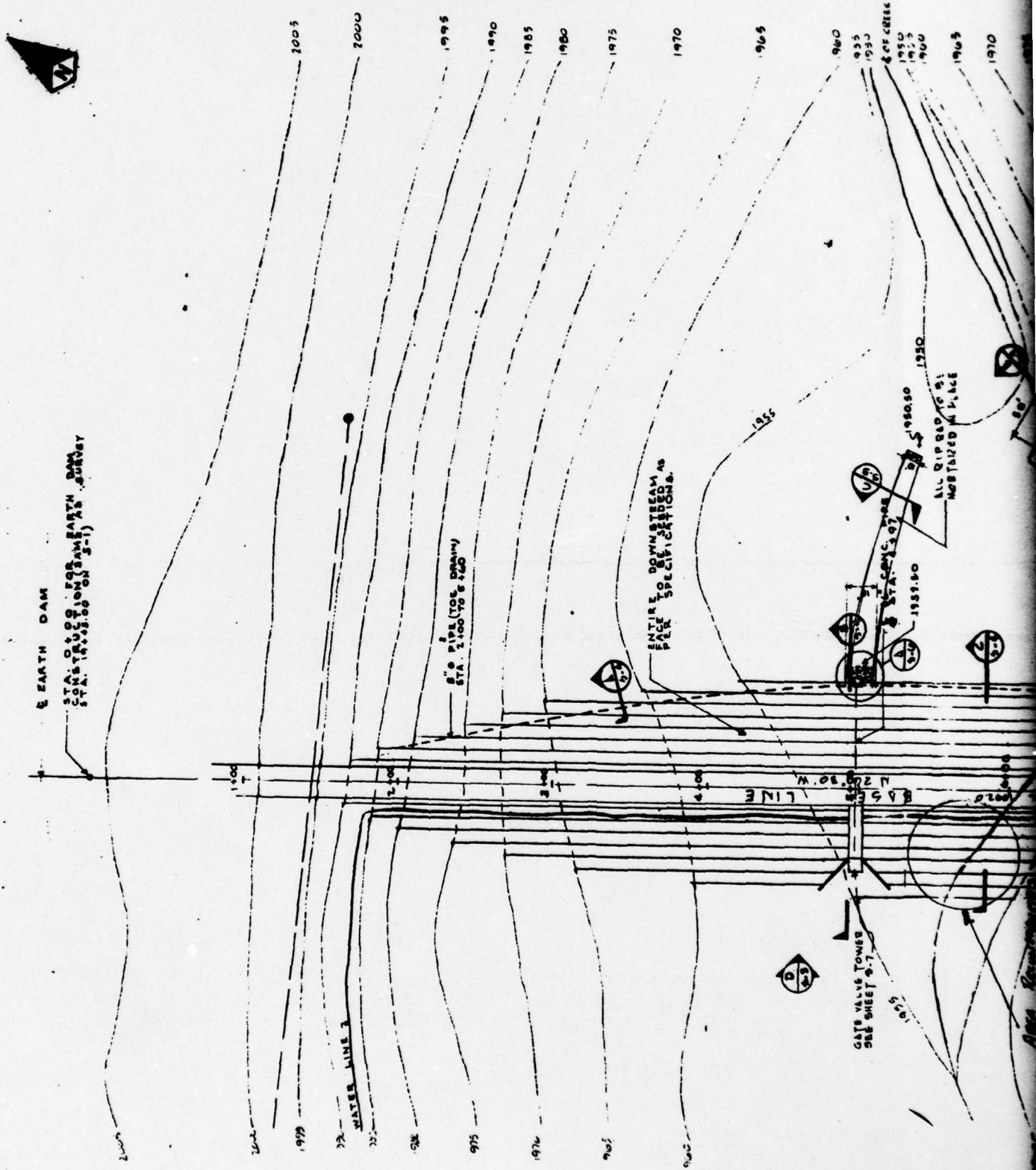
DATA OBTAINED FROM BURNS AND LOEWE ARCHITECTS & ENGINEERS  
SCRANTON LIFE BUILDING, SCRANTON, PA. DRAWING NO. S-2, DATED  
8/14/

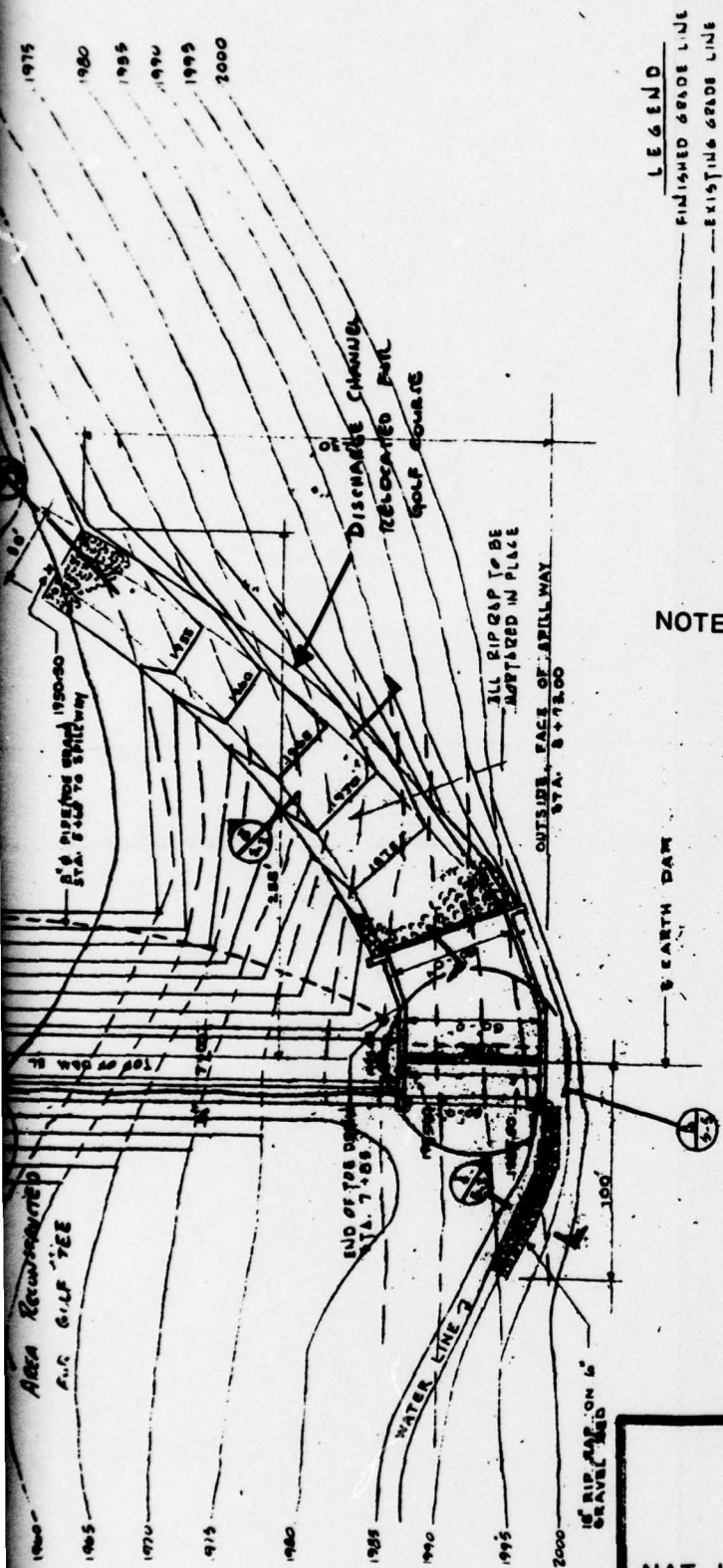
PLATE 2



E EARTH DAM

STA. 0+00 FOR EARTH DAM  
CONSTRUCTION (Same as survey  
STA. 14+00.00 ON 3-1)

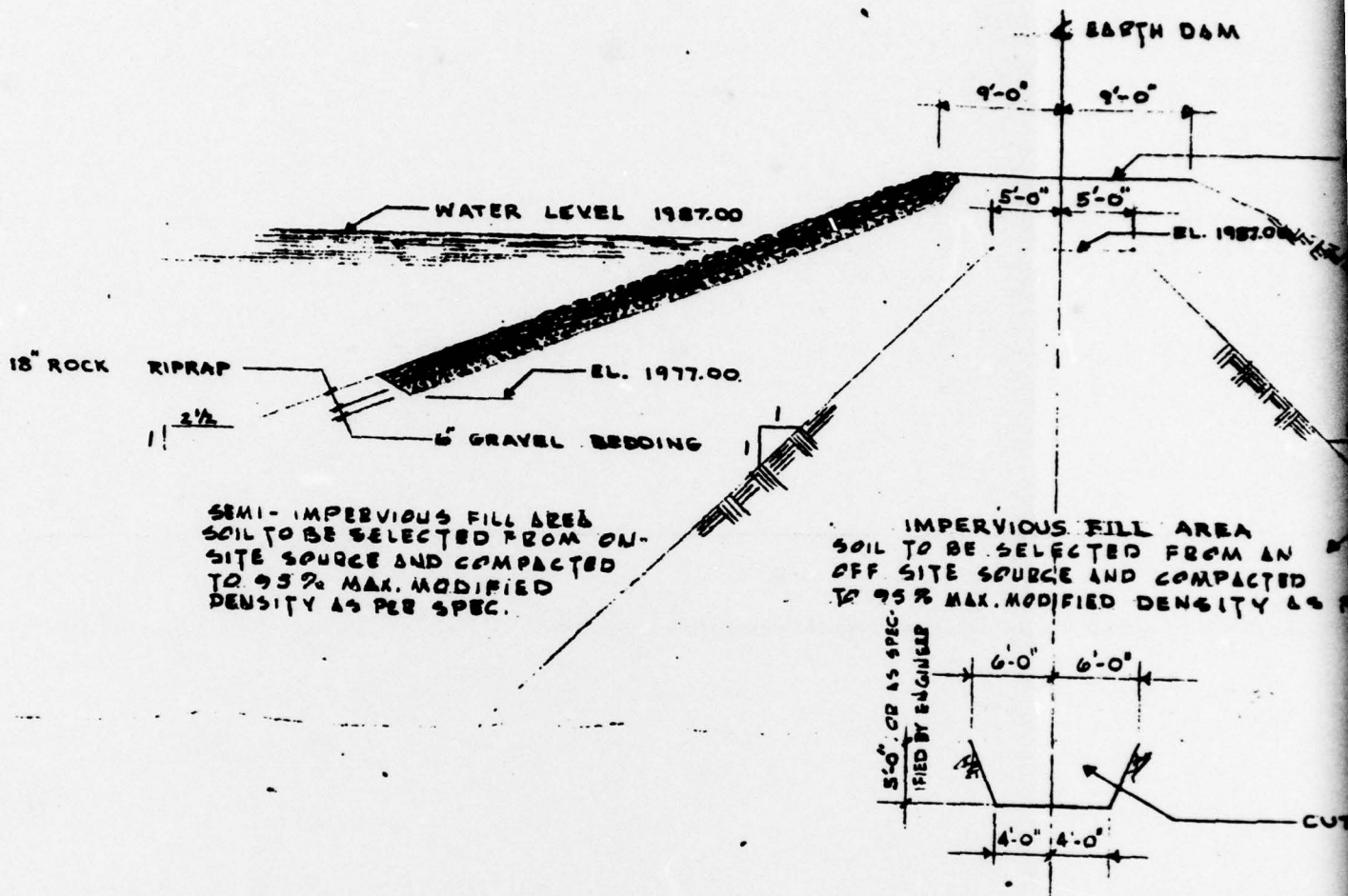




**LEGEND**  
 — FINISHED GRADE LINE  
 - - - EXISTING GRADE LINE

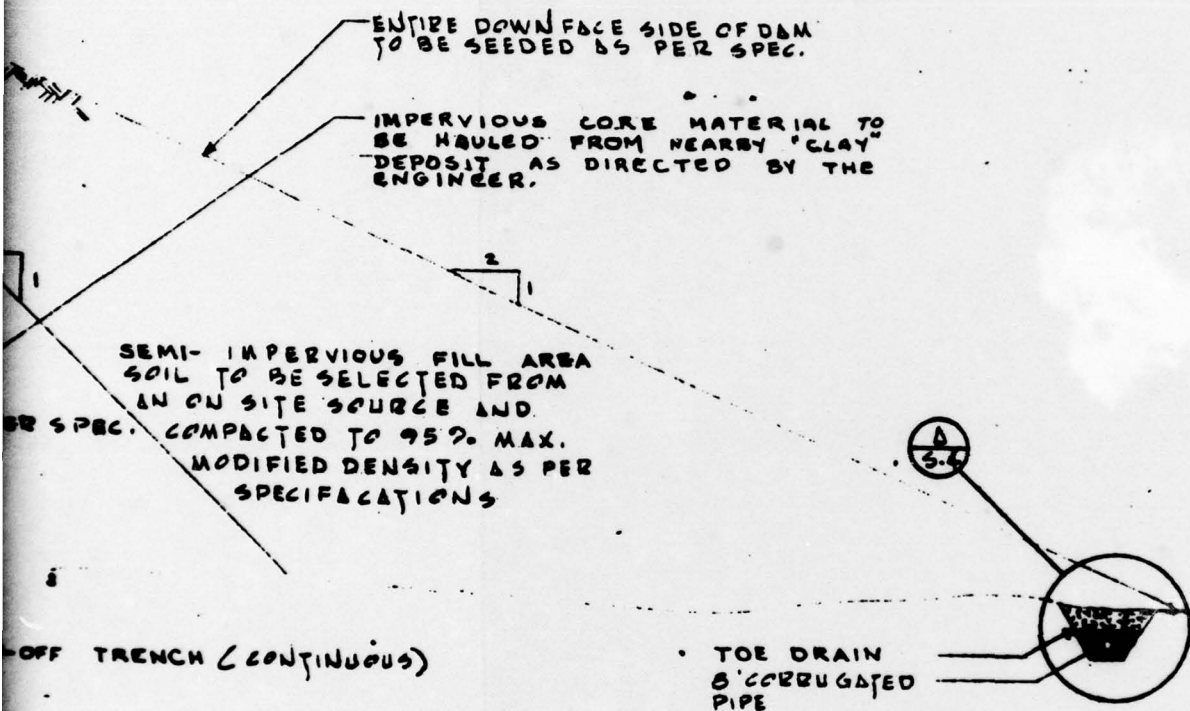
NOTE: "AS-BUILT" CONFIGURATION OF PRINCIPAL AND EMERGENCY SPILLWAY DISCHARGE CHANNEL IS SHOWN IN APPENDIX B, SHEET 5A

<b>PLAN OF DAM AND SPILLWAY MOUNT AIRY DAM</b>	
NAT. I.D.NO.PA.00811	MONROE COUNTY
DATA OBTAINED FROM BURNS AND LOEWE, ARCHITECTS & ENGINEERS SCRANTON LIFE BUILDING, SCRANTON, PA. DRAWING NO. S-3, DATED 8/14/70	
<div style="border: 1px solid black; padding: 5px; display: inline-block;">           PLATE 3         </div>	





1992.00



**TYPICAL EMBANKMENT SECTION**

**MOUNT AIRY DAM**

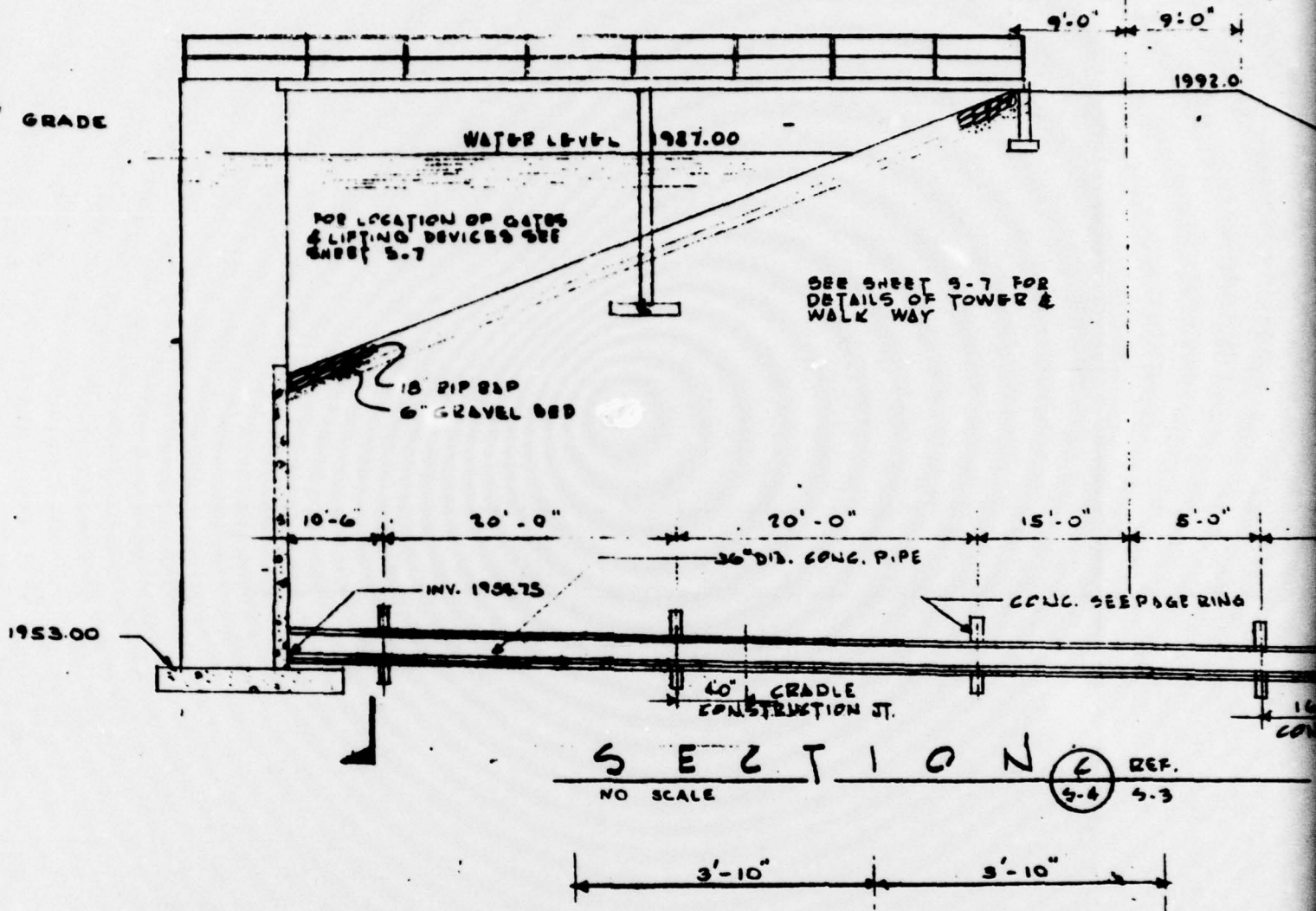
NAT. I.D.NO.PA.00811

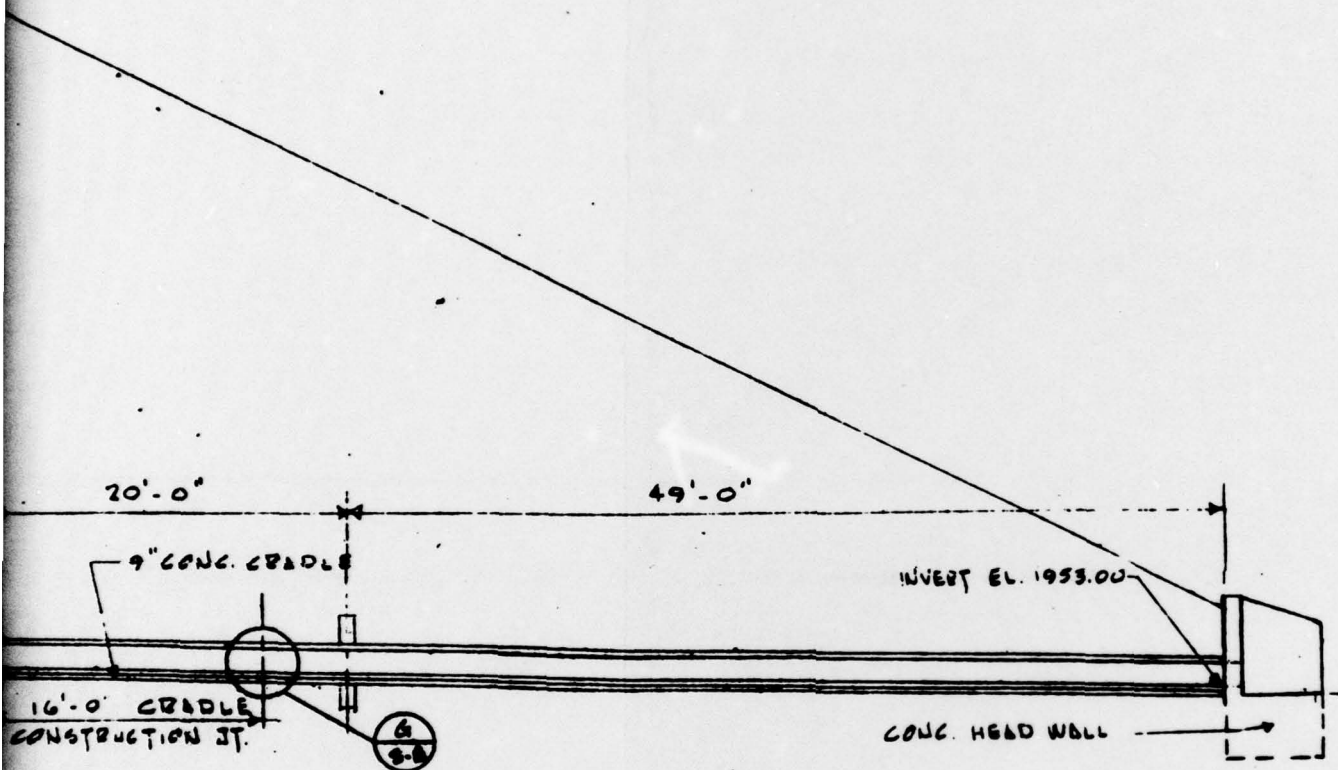
MONROE COUNTY

DATA OBTAINED FROM BURNS AND LOEWE, ARCHITECTS & ENGINEERS  
SCRANTON LIFE BUILDING, SCRANTON, PA. DRAWING NO. S-4, DATED  
8/14/70

PLATE 4

WITH  
CIAL GRADE





**PROFILE OF PRINCIPAL OUTLET SYSTEM  
MOUNT AIRY DAM**

NAT. I.D.NO.PA.00811

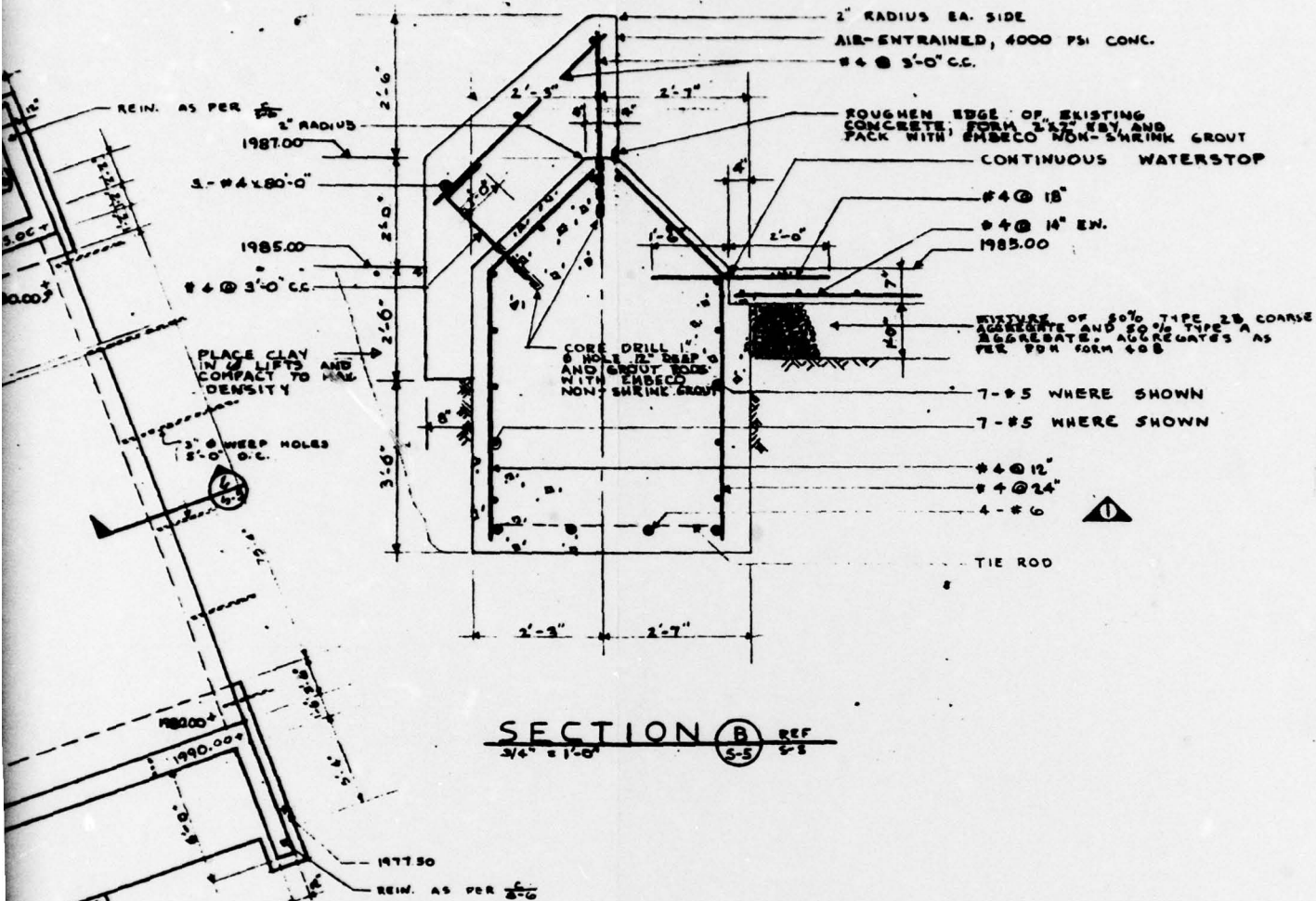
MONROE COUNTY

DATA OBTAINED FROM BURNS AND LOEWE, ARCHITECTS & ENGINEERS  
SCRANTON LIFE BUILDING, SCRANTON, PA. DRAWING NO. S-4, DATED  
8/14/70

PLATE 5







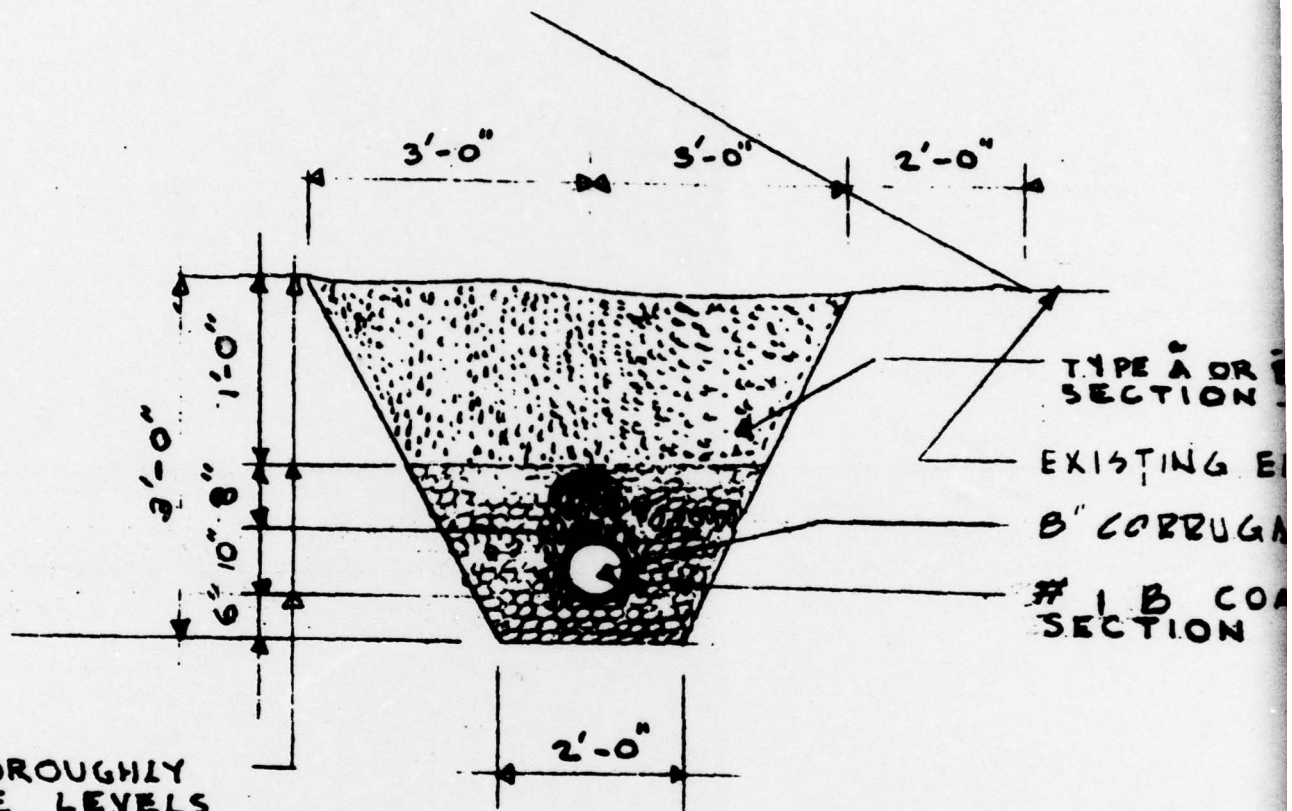
PLAN OF SPILLWAY AND SECTION OF WEIR  
MOUNT AIRY DAM

NAT. I.D.NO.PA.00811

MONROE COUNTY

DATA OBTAINED FROM BURNS AND LOEWE, ARCHITECTS & ENGINEERS  
SCRANTON LIFE BUILDING, SCRANTON, PA. DRAWING NO. S-5, DATED  
8/14/70

PLATE 6





B FINE AGGREGATE AS PER  
-703.1 OF PDH FORM 408

EARTH SURFACE

ATED PIPE

ARSE AGGREGATE AS PER  
703.3 D

**TYPICAL SECTION OF TOE DRAIN**

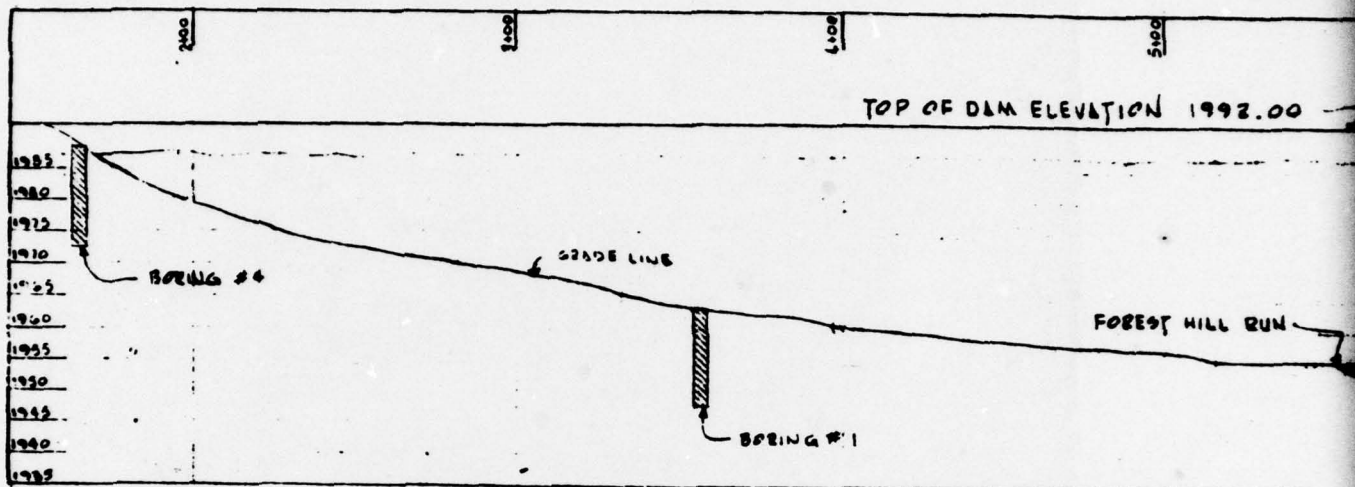
**MOUNT AIRY DAM**

NAT.I.D.NO.PA.00811

MONROE COUNTY

DATA OBTAINED FROM BURNS AND LOEWE, ARCHITECTS & ENGINEERS  
SCRANTON LIFE BUILDING, SCRANTON, PA. DRAWING NO. S-4, DATED  
8/14/70

PLATE 7



## ELEVATION

VERTICAL SCALE - 1" = 20'  
HORIZONTAL SCALE - 1" = 40'

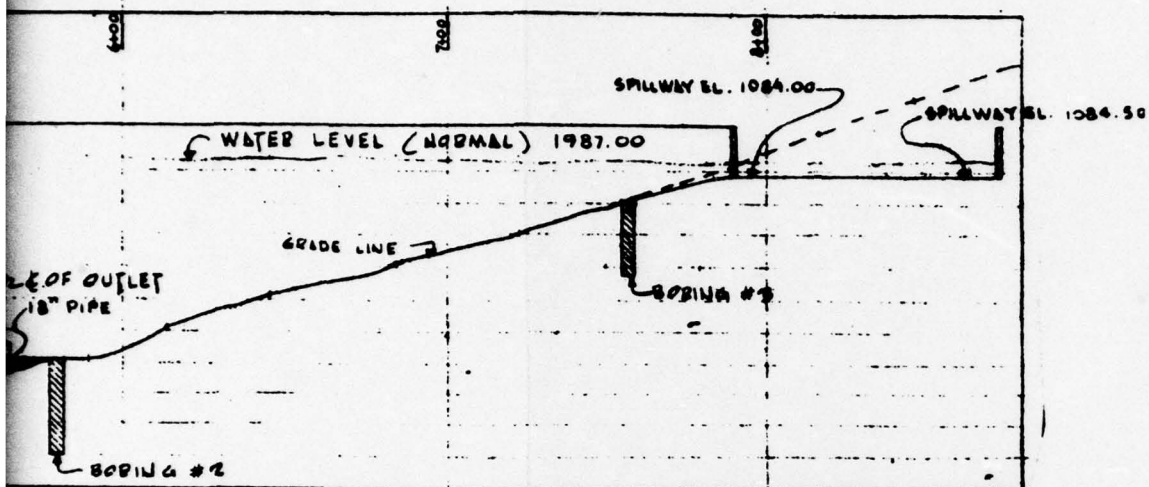
D. 2  
5-3

HOLE #1	
2'	ORGANIC SILT AND CLAY
5'	SANDY CLAY WITH BROKEN STONES
11'	BROKEN STONE LAYER (NOTED BY OUTCROPPING)
12'	GRAVELLY SAND
13'	GRAVELLY SAND

HOLE #2	
1'	ORGANIC SILT AND CLAY
2'	GRAVELLY SAND
15'	GRAVELLY SAND

HOLE #3	
1'	ORGANIC SILT AND CLAY
4'	SANDY CLAY WITH BROKEN STONES
11'	BROKEN STONE LAYER (NOTED BY OUTCROPPING)

## TEST BORING RESULTS



# HOLE #4

1'	POSSIBLE SILT, CLAY
6'	SANDY CLAY WITH BROWN STONE
8'	DENSE SAND LAYER
15'	SANDY CLAY WITH STONE

## TEST BORING RESULTS AND STRATIGRAPHIC SECTION MOUNT AIRY DAM

NAT. I.D.NO.PA.00811

MONROE COUNTY

DATA OBTAINED FROM BURNS AND LOEWE, ARCHITECTS & ENGINEERS  
SCRANTON LIFE BUILDING, SCRANTON, PA. DRAWING NO. S-3, DATED  
8/14/70

PLATE 8

2



**APPENDIX**

**F**

SITE GEOLOGY  
MOUNT AIRY DAM

Mount Airy Dam is located in the Glaciated Low Plateaus Section (adjacent to the Pocono Plateau Section) of the Appalachian Plateaus Physiographic Province. As shown on Plate F-1, the dam site and surrounding region, as is much of northeastern Pennsylvania, is underlain by the Upper Devonian age Catskill Formation which is overlain by a mantle of Wisconsin age glacial drift.

As indicated by data contained in State files, the dam is underlain by deposits of sandy silt, sandy clay, sand and gravelly sand containing some boulders. During the field inspection, it was noted that the spillway channel was cut into well bedded, fine grained sandstone which strikes north-northeast (near perpendicular to dam axis) and dips 12 degrees to the north (downstream direction). A major set of rock jointing strikes to the north-northeast and dips moderately to the north. Minor sets of rock joints strike: 1) northwest with high angle northeasterly and southwesterly dips, 2) near north-south with high angle westerly dips. The north dipping bedding planes and northerly dipping joint planes are conditions which would be prone to downstream seepage in addition to the overlying pervious soils.

